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DIV. OF ENTOMOLOGY
BULLETIN
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DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
INTRODUCTION

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(INTRODUCTION)

BY R. C. L. PERKINS

HONOLULU, H. T.
MAY 1, 1906

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LETTER OF TRANSMITTAL.

Honolulu, T. H., April 3rd, 1906.

To the Committee on Experiment Station, H. S. P. A., Honolulu, T. H.

Gentlemen:—I herewith submit for publication the Introduction to the Bulletin on "Leaf-Hoppers and Their Natural Enemies," and also an index to this Bulletin. The latter has been prepared by Mr. G. W. Kirkaldy. Although the material dealing with the subject of Leaf-Hoppers is far from being completely worked out, and new material is from time to time being accumulated, yet I have thought it advisable to close Bulletin I, which has now reached a length of more than 500 pages. At the same time, considering the practical and scientific value of such work, I hope that the subject will be continued in another Bulletin.

Yours obediently,

R. C. L. PERKINS,

Director, Division of Entomology.

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TO

ALBERT KOEBELE,

THIS RECORD OF HIS RECENT FIELD-WORK,
IS DEDICATED
BY HIS COLLEAGUES,
THE AUTHORS.

GENERAL ACCOUNT OF WORK DONE IN AUSTRALIA, FIJI AND THE UNITED STATES.

The material on which this Bulletin, entitled "Leaf-Hoppers and Their Natural Enemies," is based, has been derived from various localities and sources, which are herewith specified.

(1). In 1903 Mr. Koebele made extensive observations on this subject in North America, chiefly in the states of Ohio and California, and sent a large amount of living material to the Hawaiian Islands.

(2). In 1904 Mr. Koebele accompanied by the writer visited Australia and a still larger collection of leaf-hoppers and their enemies was made in that country.

(3). In the early months of 1905, after I returned to these islands, Mr. Koebele spent a short time in Fiji, continuing Australian studies.

(4). For several years the sugar-cane and some other leaf-hoppers and their enemies have been under close observation in the Hawaiian Islands, and a collection of these has been made.

I will now make some remarks on these various expeditions, showing what was achieved in each case.

KOEBELE'S MISSION TO THE UNITED STATES.

Mr. Koebele's researches in Ohio in 1903 were primarily undertaken on information kindly given him by Dr. L. O. Howard, of the Department of Agriculture. A short time previously Mr. Otto H. Swezey had discovered that certain leaf-hoppers in that State were attacked by Hymenopterous parasites, and Mr. Koebele was notified of this fact by the chief of the entomological staff at Washington. Mr. Koebele's investigations resulted in the discovery of many such parasites, belonging to the family Dryinidae. The appearance of these parasites is well exemplified by the "Fairchild parasite" (*Echthrodelphax fairchildii*) of the cane leaf-hopper, now so familiar to most Hawaiian cane-planters.

In addition to these Dryinidae, the little Mymarid egg-parasite of Liburnia (*Anagrus columbi*) was discovered, and also the common presence of the minute Stylopids of the genus *Elenchus* and others. Finally there was procured a single puparium of a

Dipterous parasite, from which no mature insect was bred, but it unquestionably belonged to a species of *Pipunculus.*

The immediate and actual results of Mr. Koebele's consignments of North American insects were on the whole disappointing. Neither from a purely scientific point of view, however, nor from a practical standpoint, was this material done justice to. I wish to lay particular stress on this point, because it shows at once the frequent value of work of a highly technical nature for practical purposes, even though it may be largely incomprehensible to any save an entomologist, and even to any save an advanced student of entomology. When Mr. Koebele's living specimens came to hand, I was fairly well acquainted with the published facts already known about these leaf-hopper parasites. This published information, however, was of the most meagre description, apparently only three or four of the great numbers of known species having been bred or having had their habits studied. Further, of those which had been bred, in most cases only a few individuals had been reared and information as to diversity or uniformity of habits was almost wanting. In one case only, one of these parasites had been recorded as attacking two species of leaf-hopper, and those so utterly different in all points of structure, as to lead one to suppose that the Dryinidae might be indiscriminate in their choice of host. I refer to the case of *Labeo typhlocybae* and *Dryinus ormenidis* discussed in this Bulletin on pp. 485 and 492. We now know that, in reality, these parasites generally are most particular as to their choice of host, and those which attack leaf-hoppers of the Delphacid group, to which our cane-hopper belongs, do not even extend their attacks to species outside this group, still less will they attack such different hoppers as are included in the great Jassid series. Now the living material sent to me by Koebele from North America included parasites of many small leaf-hoppers, belonging to most diverse groups, many of which would never have attacked our cane-hopper, as their structure plainly shows. It was not until I was in Australia and had leisure to examine Australian parasites with some care that I discovered the microscopic characters, which are always found in those species which attack leaf-hoppers of the Delphacid group, as opposed to those preying on Jassids. For want of this knowledge, Mr. Koebele's material from North America was, as I have said, not done full justice to from a practical point of view; much time being wasted on parasites that never would have attacked our cane leaf-hopper. Still at least two species of imported North American Dryinidae did attack our cane pest, and were reared on these in captivity, and their offspring liberated in the cane-fields, but neither of these has as yet shown up at large.

That Mr. Koebele's North American material has not been done justice to from a purely scientific point of view is due to the fact that the practical end in view, namely, to establish the parasites, naturally outweighed the former. There are ten North American species described or referred to in Pt. I of this Bulletin, but the number really collected and sent by Mr. Koebele was unquestionably considerably larger. With the exception of one or two species sent in great numbers by him, no individuals were killed by me as specimens for study. Some were turned loose in cane-fields, infested with leaf-hopper, and some were placed in large cages on growing cane plants similarly affected. The preserved material therefore chiefly consists of specimens that died a natural death in these cages, and which happened to be found subsequently, together with a few examples that emerged and died on the way to the islands, and, again, of a few examples collected and mounted by Koebele himself in Ohio and California.

From another point of view Mr. Koebele's work in Ohio and California was of great value, for it was extensive enough to show what kind of natural enemies of leaf-hopper might be looked for in other countries. In fact it was these prior investigations in North America that led him at once to investigate the eggs of the cane leaf-hopper in Australia for internal parasites and to at once discover their presence on this investigation.

MISSION OF KOEBELE AND PERKINS TO AUSTRALIA.

We reached Sydney in May, the weather being cold and on our first arrival very wet, so that little entomological work was done there. Mr. Koebele, however, wished to visit some of the orange orchards in the vicinity, with which he had become well acquainted on some of his earlier missions. A number of species of living ladybirds were accordingly collected and shipped to Honolulu. Being too far south for cane, not much attention was paid to leaf-hoppers, but the presence of hymenopterous parasites was demonstrated by the discovery of Dryinid sacs on the larvae of common Jassids.

Early in June we arrived at Brisbane, and on the first cane that we saw, a few plants in the public gardens, we at once observed the presence of the cane leaf-hopper. A short stay of about ten days gave ample proof of the existence in Australia of a considerable variety of Hymenopterous parasites of leaf-hoppers, of Dipterous parasites of the genus *Pipunculus,* and of Stylopid parasites of the genus *Elenchus.*

At Bundaberg, about twelve hours by rail north of Brisbane, we spent another ten days in June. Here is an extensive cane district with our leaf-hopper everywhere present, but never in numbers such as we are accustomed to in these islands. In fact we never saw the hoppers nearly as numerous as they are on our least affected plantations. From eggs collected here Mr. Koebele soon bred out specimens of the Mymarid parasites he had felt so confident of finding.

From our observations on the habits of the cane leaf-hopper in these islands, it seemed probable that in tropical Australia this species would be in its greatest numbers in the colder months, so after a brief stay in Bundaberg, we proceeded north to Cairns, which place we reached at the beginning of July. This plan seemed very expedient, for by retreating gradually towards the south, as the hot season advanced, we hoped to prolong the season during which natural enemies for the cane leaf-hopper could be obtained. It appeared likely that effective work could only be done at Cairns for a month or two, since without a reasonably large supply of hoppers, it was evident that the parasites could not be found in sufficient numbers for shipment. This indeed proved to be the case, and by the end of August, leaf-hoppers and their eggs had become so scarce in the cane-fields, that we came south again to Bundaberg. At Bundaberg we made a long stay on this occasion, regularly sending off consignments of parasites, until here too, owing partly to the season and partly to the harvesting of the crop, the locality became unprofitable. After a short stay in Brisbane, at the end of the year, I returned to Honolulu, while Mr. Koebele proceeded to Sydney, where his attention was largely given to collecting beneficial insects for pests other than leaf-hopper. On the return journey Mr. Koebele spent one month in Fiji, the enemies of the cane-hopper in those islands being mostly similar to those already found in Australia. A fine consignment of the Chalcid egg-parasite (*Ootetrastichus*) of leaf-hopper was most important, as it enabled us to establish that important species without any doubt.

V

MODE OF SENDING OVER PARASITES.

During the earlier part of our Australian trip all beneficial insects sent from Cairns were placed in cold storage. The fact that the coast steamers generally failed to make close connection with those leaving Brisbane or Sydney for Honolulu, and the necessity for reshipment and removal from the cool chamber, made it a matter of great difficulty to get any insects over alive. Of some predaceous species, however, such as certain ladybirds and some others, a small percentage of some species survived their long journey. These were packed in the way usually adopted by Mr. Koebele, in specially made wooden boxes nearly filled with slightly damped *Sphagnum* moss. The sides and bottoms are dove-tailed and hold well together in spite of the great dampness of the cool chamber. These boxes are made in three sizes, nesting within each other, the largest 4x3½x2½ inches, the smaller 3¾x2¾x2¼ inches. When filled each is securely bound with strong string and the whole made up in one parcel for shipment, being wrapped in several sheets of stout packing paper.[1]

With the very minute and delicate egg-parasites of the Eulophid and Mymarid families, which we were most anxious to get established in the islands, various methods were used. The cuttings of the midrib of cane-leaf containing eggs of leaf-hopper were made as short a time as possible before the steamer sailed. That they contained numerous parasites was certain from the samples we always retained to be sure on this point. Though these samples were always very small compared with the amount sent, yet we never failed to breed many parasites. Some of the cuttings were packed in the wooden boxes above described with moss, some in similar boxes with powdered charcoal, and some in tin boxes. It does not appear, however, that from the four consignments sent from Cairns, which must have included great numbers of parasitized eggs, that any of these parasites reached Honolulu alive.

Our subsequent consignments, from Bundaberg, were more successful, as was natural, the ports of departure of the Honolulu steamers being so much nearer. Cuttings of cane leaves containing leaf-hopper eggs sent from here produced both Eulophid and Mymarid parasites on arrival in Honolulu, and in fact some individuals of most of the Bundaberg species, that we desired to establish, reached the islands alive. Thus two of the Dryinid parasites of *Siphanta* (a *Paradryinus* and a *Neodryinus*) were bred in numbers in Honolulu, and liberated for the purpose of attacking the introduced pest *Siphanta acuta*. Further, two of the small wingless species of the Dryinid family, belonging to the *Gonatopus* group, were likewise successfully imported, and one of these was successfully bred up in captivity on the cane leaf-hopper. A Proctotrupid parasite (*Aphanomerus pusillus*) that destroys the eggs of the *Siphanta* above mentioned, was also successfully imported, and is now well established at large in the islands and is already destroying a large percentage of the eggs of that leaf-hopper. All these were sent over from Bundaberg in cold-storage, the Dryinidae as larvae in the cocoon or pupae. Although eventually egg-parasites of the cane leaf-hopper were obtained from sections of leaf containing the eggs, sent in cold storage, yet it was, as has been shown, only after many attempts had proved unsuccessful. At one time it seemed as if the prolonged cold temperature of (supposedly) *from 40°-45° F. was fatal to every parasite, and so far as we know, it was so in the case of all those sent from Cairns, but not always to those from the less distant Bundaberg. This led me to suggest that we should have some special cages made, somewhat similar to those Mr. Koebele had previously employed in shipping stylopized leaf-hoppers from North America, in which living cane could be grown and the cages themselves sent on the open deck, allowing the delicate egg-parasites to emerge and reproduce in transit. For minute and delicate parasites, inhabitants only of tropical countries, there is very little doubt in my mind that this method of transportation surpasses all others. In fact the two first cages sent in this way, each stocked with a different species of Mymarid, both yielded parasites after their arrival in Honolulu. These cages were built very strongly and with considerable care, special precautions being taken by simple devices that everything fitted compactly and that light was entirely excluded at all joints and that escape of any insects would be impossible. The adjoining figure shows the construction. The top and front are both hinged, so as to be capable of being fully opened out; in the back and front are cut openings of 9 inches by 11; these openings being covered on the inside with fine strong white muslin fastened with shellac, and on the outside, as a protection, with a sheet of strongly perforated zinc, which itself is still further protected by transverse wooden bars. Although in such a cage the light is necessarily largely cut off, yet grass or cane plants will grow therein for weeks, though the leaves may become chlorotic. As a matter of fact, we chiefly used pieces of cane-stem planted in almost pure white sand, for these will root and the eyes sprout quite successfully under such conditions. A removable zinc tray fitting the bottom of the cage holds the sand or soil. For the journey this tray was securely fastened down by a couple of small nails.

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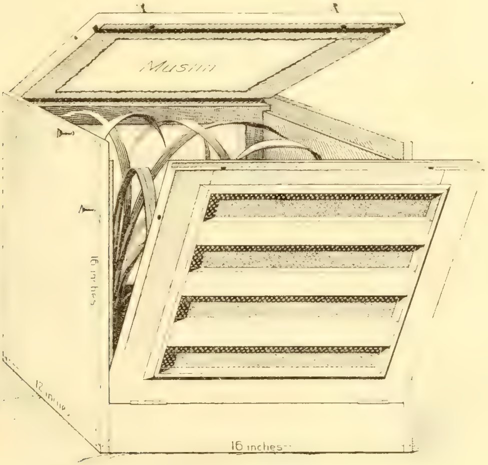
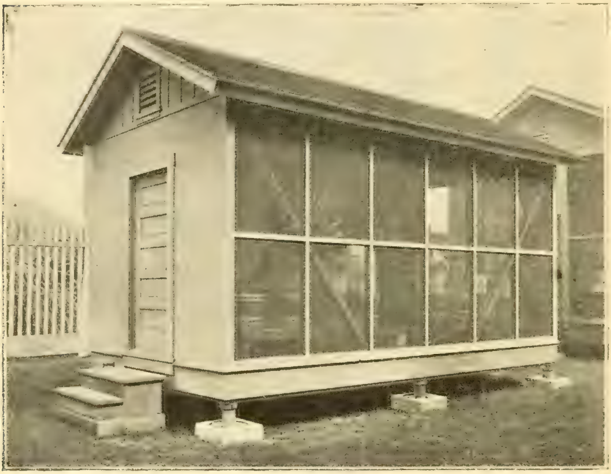
* A temperature of 28°-32° for two weeks was fatal to every egg of the leaf-hopper and to the parasites.



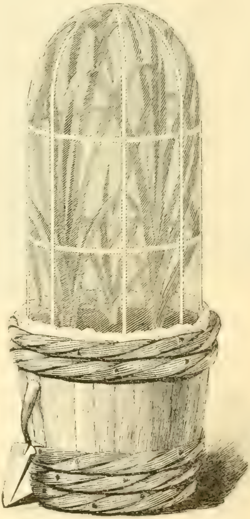
HANDLING OF BENEFICIAL INSECTS AFTER ARRIVAL.

The successful handling of the various parasites and predaceous insects after their arrival was of course all important. The latter are generally of a much hardier nature than the former and any one at all accustomed to raising broods of insects can successfully propagate such creatures as ladybirds in captivity, provided that their proper food is procurable and climatic conditions permit. It is clear that for practical purposes the discovery of a parasite of an injurious insect counts for little (except for such scientific value as it may have) unless it can be transported alive to the country where it is needed, and again the discovery and successful transportation alike count for nothing economically, unless it can be established at large after its arrival. It is no doubt in many cases decidedly more easy to discover natural enemies of an insect pest than it is to establish them in a new and distant country. We have heard some, who profess to be in favor of the repression of injurious insects by means of natural enemies, talk of the discovery of a parasite, as though the fact of this discovery were all important, whereas we must repeat that unless the parasite can be successfully introduced and established and duly performs its share of work in controlling the pest, the discovery is of insignificant importance. Further, cases where a single natural enemy is alone sufficient to keep down an injurious insect are rare and exceptional, and few pests are to be kept down in this way. As a rule, it is a complex of causes that keeps an insect in check, often the joint attack of various parasites and predators, and it may be various diseases and other conditions combined. Only in exceptional cases can the economic entomologist hope to succeed with a single parasite, as any practical field worker must

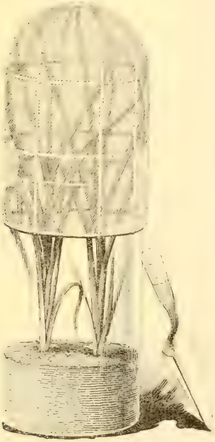


know. When beneficial insects, parasitic or predaceous, have been successfully imported, no methods by which they may be successfully established should be neglected. Predaceous insects are generally comparatively large and hardy, and can be safely liberated where their food is abundant. Parasites on the other hand are often excessively minute and delicate and may require the most careful handling. As a rule should some species that it is desirable to establish be received in any numbers, it is always safer to divide them, and adopt various methods. It may be safely said that in nearly all cases (unless climatic conditions are altogether unfavorable) half the specimens received should be at once liberated in a suitable locality. Some minute Chalcids and other parasites are very easily bred in captivity, but this is by no means always the case. In rearing insects in captivity in tropical countries, there is one absolute essential, which is perfect isolation from ants and other carnivorous creatures. Several years ago, I had built for this purpose a small house isolated from the ground, the supports rest-

ing in water or water covered with a layer of kerosene oil. Similar houses are in use at our Experimental Station (see fig. of exterior, page viii, and on page ix one corner of interior with cages). It is necessary to take care that grass and weeds do not grow up so as to form a connection with the house; and, as will be noticed in the figure, the steps are built separately, and do not actually touch the house. The sides of these houses are covered with copper wire and in stormy weather blinds of thick white canvas can be let down for shelter from the rain, or on other days as a screen from excessive sun. The wire-mesh is fine enough to prevent the escape of a moderate-sized lady-bird. The earth used for plants in these houses is soaked in boiling water to kill ants and other injurious insects that may be present in any stage, and the wooden tubs, in which the plants are grown, are similarly treated. These tubs of Japanese make (manufactured as containers of the Japanese drink "saki") often afford hiding places to centipedes, cockroaches, ants and other most undesirable insects. On one occasion some years ago, in one night I lost a whole brood of about sixty individuals of a beneficial insect, that I wished to establish, from the attack of a small centipede accidentally carried into a house in a saki-tub, that had not been treated with boiling water. These saki tubs, as shown in the adjoining figure, are excellent for growing cane or other plants, which can be covered with a cap of fine muslin, fastened on a light bamboo-frame with shellac varnish. Either by a small door or a mere hole, which can be closed with a plug of cotton, the injurious insects and their parasites can readily be turned into such a cage and allowed to breed there.



In establishing the minute parasites that destroy the eggs of leafhoppers the following procedure was adopted. I will take the case of *Paranagrus optabilis*, whose life-history I have detailed in Pt. VI of this Bulletin, as the same treatment was given to all the other minute parasites. Eight examples of the *Paranagrus* were bred from Queensland cage between January 17th and 30th. Four were liberated in the Experiment Station grounds, four were transferred to a glass-jar containing a young growing cane, in the leaves of which leaf-hopper eggs had previously been deposited. The jar used was a large glass battery-jar (the size is well shown in the adjoining figure by comparison with an ordinary garden trowel lying against it) containing very young cane plants. Round the jar near the top is bound a band of cotton or other material, on which rests the cap formed of muslin fastened over a fine bamboo framework with shellac.



These caps are remarkably convenient for handling delicate parasites. When one wishes to collect from the jar, by wrapping the whole in a black cloth and leaving only the top of the cap uncovered, after first dislodging the parasites from the plants by striking the jar with the bare hand, these will at once fly to the top of the muslin cap. The cap is then removed and laid on its side, the closed end or top being held towards the light, and the parasites can be collected in glass tubes with the utmost ease as they seek to escape at that end.

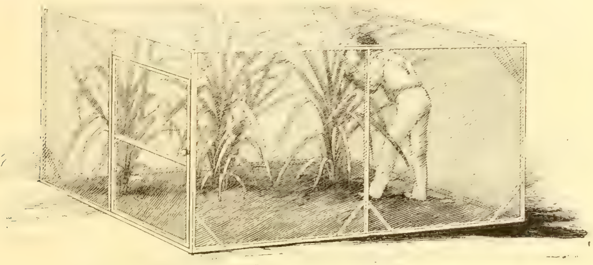
At the end of three weeks the first brood of parasites began to appear, and in all 47 individuals, all females, were obtained. Half of these were liberated, the rest being used to stock a number of new breeding jars similar to the one described. From these a very large number of individuals were reared, and these were treated in various ways.

Some were 'sleeved' out in the fields on growing cane much punctured with hopper. These muslin sleeves stretched on light bamboo framework are shown in the adjoining figures, the parasites being introduced through a small hole at the lower end, by means of a glass tube. A plug of cotton closes the hole, after they have been turned in; while in wet weather a cap of water-proof cloth can be fastened over the upper part of the sleeve to afford shelter.

In the breeding-houses large colonies were now raised on larger cane-plants in the saki tubs already mentioned; and other still larger ones in the open field beneath light portable cages, which could be placed over several entire well-grown cane-plants, and were of sufficient size to allow one to enter and examine the condition of affairs within, and to make cuttings for further distribution. These large light cages were further

screened on the windward side by a strip of heavy white canvas, to break the force of the wind. All these methods were entirely successful, not only with the Mymarids, but also with the more sturdy egg-parasite of the genus *Ootetrastichus*.

While the parasites were still comparatively scarce and not easily obtainable in numbers for distribution, they were sent out in colonies, in the glass battery-jars already figured, to such plantations as stood in most immediate need. To the various plantation agents was left the choice, as to which of their plantations should be first supplied.



Subsequently as the cane in the experiment station became well stocked with parasites, it was only necessary to take cuttings of the midribs of cane leaves well filled with eggs and send them to the plantations in a very simple form of cage. Prior experiments had proved that from such leaves parasites would continue to emerge daily for at least two weeks after the cuttings were made. All that it was necessary for the recipient to do was to hang the cage in a suitable spot, the large number of parasites that would emerge from each cage making it almost impossible to fail in establishing them. The emergence of numbers of individuals day after day rendered the occurrence of unfavorable weather (which is so frequently a cause of failure in establishing beneficial insects, when liberated at one time as adults) a matter of small account.

EFFECT OF VARIOUS NATURAL ENEMIES IN CONTROLLING LEAF-HOPPER.

Having dealt with the introduction, propagation and distribution of the several parasites, we will now consider the practical effect of these and other natural enemies in diminishing the leaf-hopper pest. There are yet in Australia and Fiji, as can be seen by the student of the various Parts of this Bulletin, a number of other natural enemies of leaf-hoppers, which, introduced, would certainly attack our cane leaf-hopper, though either we did not attempt to introduce these, or were unsuccessful in the attempt. I have already, in my last annual Report to the Committee on the Experiment Station, stated what parasites we especially desired to import and the reasons for this, but for the sake of completeness, I here make some repetition. Thus in choosing what natural enemies it was desired to introduce, we had to consider: (1) their effectiveness or importance as destroyers of the pests; (2) the possibility of successful transportation; (3) the probability of their thriving in a new country; (4) the rapidity of their increase, when established. On the first two heads, there is nothing special to remark, but the third was a matter of great importance. When one considers the excessive difference in climate between many of the plantations, the extremes being shown by one where cane is grown on the windward side at an elevation of about 1500 or more feet, with its excessive rainfall, and one nearly at sea level on the dry leeward side, where cane can exist only by constant irrigation, it is obvious that comparatively few species of insects can be expected to thrive equally well under such diverse conditions. Consequently we had need primarily of parasites of wide-spread range in their own country, not such as were of local occurrence only.

The fourth consideration, that is the rate of increase, was to us of the greatest importance, since we had to deal with a pest already established for years, and that had no doubt reached its average numerical maximum throughout the islands. In this the little Mymarid egg-parasites of the genera *Anagrus* and *Paranagrus* excel. They complete their life cycle in about three weeks in these islands, and apparently breed at the same rate, or nearly so, at all seasons of the year. Further they are largely parthenogenetic, the male sex being only produced at rare intervals.

The Tetrastichine egg-parasite (*Ootetrastichus*) on the other hand is a comparatively slow breeder, taking fully twice as long as a Mymarid to complete its life-cycle or longer still. It however probably produces twice as many eggs as the other and is, so far as is known, entirely parthenogenetic, no male having ever been seen. If we judge the effectiveness of the two parasites merely on rate of increase (reckoning the life cycles as 20 and 40 days respectively), and suppose that the Mymarid produces 20, the Tetrastichine 40 female young, at the end of six months the latter will have produced four thousand and ninety-six million descendants, but the Mymarid in the same time will produce more by one million times. In reality no case is of this simple nature, the habits and constitution of the parasites have to be considered. Thus the Mymarid is much more delicate than the other, and liable to be decimated by storms, but it lays its eggs within a very short time of emergence, while in *Ootetrastichus* the period of egg-laying is extended over weeks. The latter, besides its robust nature, has this advantage, that each individual is bred at the expense of *the whole contents* of an egg-chamber of the leaf-hopper, while of the Mymarid each individual is bred at the expense of only a single egg.

If we consider the effectiveness of the four egg-parasites, *Paranagrus optabilis*, *P. perforator*, *Anagrus frequens*, and *Ootetrastichus beatus*, *in areas where all are well established*, we must rate the first-named as *at present* by far the most effective. As I have previously pointed out, this species is capable by itself of destroying about 50 per cent of the cane-hopper's eggs and *Anagrus frequens* and *P. perforator*, extraordinarily numerous as they appear, where seen alone, are but as isolated examples in the crowd, where all are well established in one spot. The *Ootetrastichus* slowly but steadily increases in numbers, and on many plantations I expect that it will ultimately be the most efficient of all parasites. I do not think that it can show its full value till 1908, for each harvesting of the cane crop is necessarily a very great setback to its natural increase. *Anagrus frequens*, under which name are probably more than one species, or at least one or two distinct races of a single species, although it appears at a disadvantage, when in company with *Paranagrus optabilis*, is nevertheless a most abundant parasite. In Part VI of this Bulletin I have compared the habits of the two and need not refer to the matter here, but I may say that as many as eighty or a hundred exit holes of the *Anagrus* have been counted in a single cane-leaf, so that its great utility is unquestionable. *P. perforator,* common in Fiji, attacking eggs of hopper laid in thick stems of grass, more rarely those in cane, will probably gradually wander away from the cane-fields to attack the eggs of native hoppers, that are laid in stems and twigs, as it now chiefly attacks the cane-hopper eggs when these are laid in the stems.

Nor must it be forgotten, what valuable aid these egg-parasites receive in the control of leaf-hopper from other insects parasitic and predaceous, native or introduced. In fact, had there existed previously no restraint to the multiplication of the pest, no one who has paid the least attention to such matters can doubt that it would some time since have become impossible to raise any crop of sugar-cane in the islands. The reason why these natural enemies have not alone got the upper hand of the hopper is due to various causes. In the first place, a number of the parasites such as the Dryinid *Echthrodelphax fairchildii* and the parasitic flies of the genus *Pipunculus* are of local occurrence, and in many places cannot (for climatic or other unknown reasons) maintain their existence. This was well shown by the behavior of the first-named, which was distributed in thousands by the entomologists and the Plantation managers themselves to all the districts in the islands, but in many places did not thrive. Such, too, is the case with the predaceous black earwig (*Chelisoches morio*) which, a natural immigrant to the islands and no doubt acclimatised centuries ago, is found on comparatively few plantations. Other natural enemies are themselves periodically decimated by parasites, as is the case with the introduced green cricket (*Xiphidium varipenne*), which has its own egg-parasite (*Paraphelinus*). Other enemies like the common lady-bird (*Coccinella repanda*) introduced by Koebele years ago for other purposes, prey on young leaf-hoppers, in default of more favorite food, and this valuable predator too is itself subject to parasitic attack by the common Braconid (*Centistes*). At present the whole number of parasites and predaceous insects that attack cane leaf-hopper to such an extent as to render their services worth noting is considerable, as the following summary shows.

The most valuable are the four egg-parasites, which there is every reason to hope will become still more effective with reasonable time, one (*Ootetrastichus*) having as yet had no chance to show its full effectiveness.

The two Pipunculus flies (*P. juvator and terryi*) are restricted to certain localities and are native species, which have transferred their attacks from native Delphacids to the cane leaf-hopper.

The ubiquitous lady-bird (*Coccinella repanda*) is valuable as a destroyer of leaf-hopper, though originally imported by Koebele to destroy Aphis. It is hoped that other lady-birds, especially *Verania strigula* (=*V. lineola* of Pt. VII) may become established and do good work, as in Australia and Fiji, whence they were imported.

The earwig *Chelisoches morio* is a local species, but no doubt useful where it exists in numbers.

The green cricket (*Xiphidium varipenne*) is very valuable, but is most unfortunately heavily attacked at certain seasons by an egg-parasite.

The Dryinid *Echthrodelphax fairchildii* is locally valuable. At certain seasons in suitable, but limited, localities, it destroys a considerable percentage of hoppers. Its services are underestimated, because for a large part of the year it lies as a dormant larva in the cocoon, and parasitized hoppers at such a time are naturally hardly to be found.

There are many other natural enemies of more or less importance, e. g. the various predaceous Hemiptera, and the several lace-wing flies (Chrysopinae).

In addition to these insect enemies, we must mention the two fungous diseases of hoppers (amounting locally and at certain seasons to epidemics) which, long previously known to kill the native leaf-hoppers, have become transferred to the introduced pest. We also found one or more fungous diseases attacking leaf-hopper eggs in Fiji and Australia in all localities. With material imported from these countries, I easily infected eggs of the cane leaf-hopper under cover, and subsequently established the fungus at large in the field. As it was most probable that parasitized and healthy hopper eggs would be affected alike by the disease, and consequently many of the egg-parasites would be destroyed, it became a subject of discussion whether we should attempt to establish the fungus or not. As, however, throughout Australia, the fungus and parasite both attacked the eggs, Mr. Koebele was of opinion that we should try and establish the same conditions here. Consequently with the first cages sent to the plantations the cane cuttings and the cane itself were well sprayed with water containing spores of the fungous disease, so that these would be certainly carried abroad by the emerging hoppers and parasites. I imagine there is no doubt as to this disease becoming established in all suitable localities.

The question that one will now ask is: Are these parasitic and predaceous enemies combined sufficient to prevent any further serious damage from leaf-hopper? Though a natural one, it is hardly yet a fair question. The leaf-hopper was in numbers sufficiently great as to be injurious in 1900, and spread and increased greatly since that time. The distribution of imported natural enemies began about a year ago. Some of the best of these have been distributed much more recently still. To serve fifty or more plantations, many of great acreage and occupying many miles of country, with introduced parasites, must naturally take considerable time. One of our most important parasites, if it thrives here as in Fiji, as I have already pointed out, is at present hardly to be reckoned with. It should be of decided value next year, of much more the year after. It is merely a question of natural increase, for that it thrives here at large as well as in captivity is already proven. When one considers the enormous monetary loss, considering the size of these islands, that has been occasioned by the leaf-hopper, I do not think one should cease to seek natural enemies against the pest, until it is absolutely proven a pest no longer, however strong one's hopes may be that the present enemies are sufficient to cope with it. I have been told on the best authority and by those most interested, that the loss to these islands caused by the cane leaf-hopper since its first noticeable appearance in 1900 to the present time may be reckoned at millions of dollars, and one is justified in taking every precaution, where so much is at stake.

ON THE NECESSITY OF FURTHER DISTRIBUTION OF PARASITES IN THE CANE-FIELDS.

Owing to the manner in which cane is cultivated in these islands, the entomologist working along the lines that have been adopted to control the leaf-hopper pest, meets with a serious obstacle such as is not encountered in dealing with insects injurious to our other vegetation. I refer here to the universal custom of burning off 'the trash' over great acreages, after the crop has been harvested. I have been told that on the Colonial Sugar Refining Company's estates in Australia no such burning off is allowed. If this is correct, it may help to account for the insignificant numbers of our cane-leaf hopper there, as well as of several other insects of the same group, which are fortunately not known in our cane fields. As, however, burning of trash is an established fact here, it becomes necessary to see what steps can be taken to provide against this serious disadvantage. I will first show whereof this disadvantage consists. The parasitic enemies of the leaf-hopper are mostly delicate and minute creatures, not accustomed to take prolonged flights. Their wings serve well to bear them from plant to plant, but for further distribution they are dependent on air-currents. If when a field of cane is cut the wind blows towards another cane field, no doubt some or many parasites will reach it, but if otherwise, probably none will do so. In burning over a field it is quite certain that almost every parasite yet present will be destroyed, but the adult leaf-hoppers on the other hand are well able to take care of themselves. When as an experiment, a patch of about nine acres of cane, so heavily attacked by leaf-hopper as to be useless, was set on fire all around to destroy these, it was noticed that the adult hoppers rose from the cane in a cloud and spread to other fields; so this plan for destroying them was of no value. I have in an earlier publication shown how quickly the leaf-hoppers spread to new fields of very young cane, and with what regularity they distribute themselves over the young plants. It cannot be hoped that the parasites will (except under rare and fortuitous circumstances, such as constant favorable winds) spread themselves in like manner, and in the same time. Yet it is essential that the parasites should be on the spot when the leaf-hopper *begins to lay* in order to secure proper control. If the supply of laying hoppers at the beginning of the great breeding season is very small, it means that there is not time for the attack to become serious before that season is over. It is when the hopper is least abundant, that one wants to be assured that it is being attacked by all possible enemies. When a field is already seriously injured and swarming with hoppers, not much immediate help can be given for obvious reasons. It will be easier to prevent such a condition than to find a remedy. If one could provide that in each large area of cleared land, ready for planting, there should be in the middle a small patch of some variety of cane most susceptible to the attack of leaf-hoppers, that this cane should be kept well stocked with these, and with a variety of parasites and predaceous insects, and itself be of sufficient growth to afford good shelter to all these, the condition from an entomological standpoint would be ideal. This patch of cane, being already of suitable age and growth and stocked as aforesaid, at the time the much younger cane of the rest of the field began to be infested with hoppers, would daily be distributing thousands of natural enemies, that should control these. Although such a plan or modification of it might be adopted on some plantations, on others (at least such as are under irrigation) it would either be difficult, or altogether impracticable. Only in the case of some fields of long ratoons would the matter be very simple, when a small area of the original ratoon growth in each field could be left uncut, and if well supplied with hoppers and their natural enemies would serve later on to stock the rest of the field. Unfortunately, owing to the fact that ratoons are (except in unusual cases) not severely attacked as compared with plant-cane, this matter becomes one of minor importance. Otherwise, in the majority of cases, owing to the clearing of large areas and the burning of trash, it is probable that new fields will have to be supplied by cages similar to those already used. Two things will be absolutely necessary: (1) that the new fields be well supplied with parasites; (2) that they be stocked immediately the hoppers enter them and commence laying. This plan, though less satisfactory than would be the other method, is nevertheless simple, and does not call for much expenditure of time, nor for skilled labour. The one thing necessary to be positively ascertained is that the spot whence the cuttings for distribution are taken is well supplied with *all* the kinds of parasites that it is desired to establish in new fields. It is now well known to us that *all* these destroyers are not yet established *in all parts* of all plantations, and therefore at present unless an entomologist previously test samples from the spot, whence distribution is to be made, it is quite likely that some of the most valuable parasites will not be taken to the new fields. If a sample be submitted to the entomologists, it can be passed as fit to supply all necessary parasites to new fields, or if not, cages of the deficient species can always be supplied from the cane in the grounds of the Experiment Station in Honolulu. As the parasites are continually spreading and increasing, such expert examination will at the most be necessary for a year or two; for it is perfectly certain that by that time all the species will be so general that it will be quite impossible to take any extensive sample of cane-leaves that bear eggs of leaf-hopper, which will not contain all. Such in fact is now the case in the cane at the Experiment Station. To sum up, the clearing of all cane from large acreages is a decided obstacle to the complete success of natural enemies of leaf-hopper, and the burning of trash aggravates the difficulty. As an offset to these conditions new fields should be supplied artificially with natural enemies, and they should be supplied as soon as any leaf-hoppers enter them. Of course future observation may prove this distribution unnecessary, but for the present it should be adopted.

LIST OF PARASITES AND THEIR HOSTS.

Below are listed the parasites and hyperparasites treated of in detail in the various parts of this Bulletin. In many cases it is not possible at present to give the exact host of each parasite, even though the latter was bred. In the first place, of the great number of species of leaf-hoppers collected by us in Australia, only about half are yet described, and in the second, many of the parasites were obtained only from nymphs, which, in the present state of knowledge, even the special student of Homoptera will probably be at a loss to refer with certainty to their proper species. The name "Liburnia," often cited below as a host, must be regarded in a very wide sense, somewhat as in Edwards' "British Homoptera," where it includes a number of recognized European genera. Applied to the Australian forms in the list below, it is likewise a composite genus, the components of which do not however, at least as a rule, agree with those in the work just mentioned. In this list of hosts, the leaf-hoppers have mostly been determined by Mr. Kirkaldy, but for the reasons given, comparatively few are referred to specifically. Consequently it is not necessary, nor advisable, at present to make a second list, giving first place to the hosts, though I hope that this may be done, when the working out of the Homoptera is completed. In the case of the Dryinidae I have listed all the species dealt with in this Bulletin, since only seven of the 65 have not been bred, and attention is thus called to those species about which information is wanted.

HYMENOPTEROUS PARASITES.

FAM. DRYINIDAE.

Parasite	*Host.*
Pseudogonatopus	
kurandae	Liburnia sp. nymph and adult.
juncetorum	Liburnia and other Delphacids, nymphs and adults.

Parasite	*Host*
palustris	Various Delphacids allied to Liburnia, nymphs and adults.
saccharetorum	Perkinsiella saccharicida, nymph and adult.
dichromus	Liburnia spp. nymphs and adults.
americanus	Liburnia sp.
opacus	Liburnia sp. (near Chloriona).
stenocrani	Stenocranus dorsalis, nymph.
melanacrias	Delphacid near Stenocranus.
kiefferi	Vanua vitiensis probably.
perkinsi	Various Delphacids allied to Liburnia, nymphs.
Haplogonatopus	
apicalis	Liburnia and other Delphacids.
moestus	Hadeodelphax, nymph.
brevicornis	Liburnia sp. (near Chloriona).
americanus	Liburnia spp.
vitiensis	Delphacid near Stenocranus.
Paragonatopus	
nigricans	Liburnia or allied forms.
Gonatopus	
australiae	Deltocephalus and other Jassids, nymphs and adults.
koebelei	Athysanus sp.
Neogonatopus	
ombrodes	Deltocephalus sayi.
erythrodes	Deltocephalus ?
obscurissimus	Deltocephalus ?
pulcherrimus	Nephotettix plebeius adult.
dubiosus	Deltocephalus, Nephotettix and other Jassids.
brunnescens	Athysanus curtisii.
pallidiceps	Athysanus sp.
vitiensis	Euleimonios sp.; also from Deltocephalus nymph.
Epigonatopus	
solitarius	Not bred.
fallax	Not bred.
Pachygonatopus	
melanias	Euleimonios and Athysanus, adults.

Parasite	*Host*
Chalcogonatopus	
gigas	Tartessus syrtidis, nymph.
optabilis	✓Deltocephalus, nymph, and Nephotettix, adult.
decoratus	Phrynophyes.
pseudochromus	Phlepsius.
Echthrodelphax	
fairchildii	Perkinsiella saccharicida, Aloha ipomoeae, etc., nymphs.
nigricollis	✓Various small Delphacids, Hadeodelphax, forms allied to Liburnia, etc., nymphs.
bifasciatus	✓Liburnia and allied forms, nymphs.
Dryinus	
ormenidis	Ormenis pruinosa and septentrionalis, nymphs.
Neodryinus	
koebelei	Colgar peracutus nymph.
nelsoni	Colgar peracutus nymph.
raptor	Siphanta, Sephena, Aphanophantia, Privesa, Scolypopa, Massila, Gaetulia, nymphs.
Paradryinus	
koebelei	Colgar, Siphanta, Massila, Aphanophantia (?) nymphs.
venator	Privesa, Massila and Siphanta nymphs.
threnodes	Siphanta and Colgar, nymphs.
gigas	Not bred.
leptias	Hasta hastata, nymph.
varipes	Siphanta, nymph.
Chlorodryinus	
pallidus	Nymph of (probably) Siphanta.
pseudophanes	Not bred.
Thaumatodryinus	
koebelei	Young nymph of Siphanta.
Eukoebeleia	
mirabilis	Bruchomorpha, nymph, and both short and long-winged adult.

Parasite	*Host*
Neochelogynus	
typicus	Not bred.
nitidus	Eurinoscopus spp.
leiosomus	Eurinoscopus sp. nymph.
dimidiatus	Eurinoscopus sp. nymph.
nigricornis	Eutettix sp. nymph and adult.
destructor	Eurinoscopus, nymph and adult.
cognatus	Idiocerus or Macropsis? nymph.
parvulus	Euleimonios? adult.
coriaceus	Euleimonios adult.
pallidicornis	Deltocephalus? nymph.
ignotus	Not bred.
Prosanteon	
chelogynoides	Tartessus (?) nymph.
melanostigmus	Not bred.
Paranteon	
myrmecophilus	Ipo spp, nymphs and adults.

FAM. PLATYGASTERIDAE.

Aphanomerus	
bicolor	Eggs of Eurybrachyine Fulgorids.
niger	Eggs of Eurybrachyine Fulgorids.
rufescens	Eggs of Siphanta or allied genera.
pusillus	Eggs of Siphanta.

FAM. MYMARIDAE.

Ooctonus	
australensis	Eggs of Tettigonia (albida or parthaon).
Gonatocerus	
cingulatus	Eggs of Tettigonia albida.
Alaptus	
immaturus	Eggs of Psocid feeding on fungus growing on honeydew excreted by leafhoppers.
Polynema	
reduvioli	Eggs of Reduviolus blackburni.
Anagrus	
frequens	Eggs of Liburnia or allied Delphacids.
columbi	Eggs of Liburnia.
Paranagrus	
optabilis	Eggs of Perkinsiella saccharicida.
perforator	Eggs of various genera of Delphacids.

FAM. ENCYRTIDAE.

Parasite	*Host*
Meniscocephalus eximius	Eurinoscopus sp.
Fulgoridicida dichroma	Eggs of Eurybrachyine Fulgorid.
Neocladia howardi	Eurinoscopus sp., nymphs and adult.
Echthrodryinus destructor	Neodryinus, Paradryinus, etc., larvae.
Echthrobaccha injuriosa	Baccha siphanticida (puparium).
Ectopiognatha	
minor	Eggs of Siphanta.
major	Eggs of Platybrachys?
Echthrogonatopus	
exitiosus	Many species of the Gonatopus group of Dryinidae, larvae.
pachycephalus	One or more of the Gonatopus group of Dryinidae, larvae.
Helegonatopus pseudophanes	One or more of the Gonatopus group of Dryinidae, larvae.
Chalcerinys eximia	Neogonatopus and probably allied genera, larvae.
Saronotum	
australiae	Pseudogonatopus dichromus, larva.
americanum	Pseudogonatopus, larva.
Cheiloneurus	
swezeyi	Dryinus ormenidis, larva.
gonatopodis	Pseudogonatopus, Echthrodelphax, larvae.
chlorodryini	Chlorodryinus pallidus larva.
Anastatus pipunculi	Pipunculus cinerascens, also Paradryinus.

FAM. EULOPHIDAE.

Parasite	*Host*
Ootetrastichus	
beatus	Eggs of Perkinsiella saccharicida and vitiensis.
Paraphelinus	
xiphidii	Eggs of Xiphidium varipenne.

FAM. TRICHOGRAMMIDAE.

Pterygogramma	
acuminata	Eggs of Tartessus syrtidis.

COLEOPTEROUS PARASITES.

FAM. STYLOPIDAE.

Halictophagus	
schwarzii	Agallia (?) sp. adult.
americanus	Agallia 4-notata, adult.
australensis	Tettigonia parthaon; and a species, possibly the same, attacks T. albida and others; adults.
phaeodes	Hecalus immaculatus, adult.
stenodes	Paradorydium menalus, adult.
Megalechthrus	
tryoni	Platybrachys or allied forms, adult.
Elenchus	
tenuicornis	Liburnia various species, also various other Delphacid genera e.g. Hadeodelphax, nymphs and adults.
Deinelenchus	
australensis	Platybrachys or allied forms, adult.

N. B. In Australia stylopized examples of Phlepsius?, Eutettix, and nymphs of Deltocephalus were also found, bearing male puparia of the parasite.

DIPTEROUS PARASITES.

FAM. PIPUNCULIDAE.

Pipunculus	
cruciator	Hecalus immaculatus. mature and nymph, also Tartessus nymph.
eucalypti	Rhotidus sp. nymph.
erinys	Eurinoscopus nymph.

Parasite	*Host*
hylaeus	Eurinoscopus adult and nymph.
comitans	Athysanus.
cinerascens	Probably on Privesa, nymph; the puparia of the parasite being found commonly on trees affected by these hoppers.
beneficiens	Various common Jassids, adult and nymphal, Phrynophyes, Deltocephalus, Athysanus.
helluo	Colgar peracutus nymph also nymphs of Gaetulia chrysopoides.
koebelei	Thaumatoscopus and Vulturnus, nymph.
monas	Deltocephalus (?) nymph.
picrodes	Tartessus sp.
anthracias	Thamnotettix (?), adult.
xanthocnemis	Liburnia or allied form, adult.
synadelphus	Deltocephalus nymph.
pseudophanes	Hecalus immaculatus.
juvator	Aloha spp., Perkinsiella saccharicida.
oahuensis	Aloha ipomoeae.
terryi	Not bred, but in company with Perkinsiella, no doubt by transference from Aloha or some other native Delphacid.

FAM. SYRPHIDAE.

Baccha	
siphanticida	Preying on nymphs of Colgar, Siphanta, and Jamella.

LEPIDOPTEROUS PARASITES.

FAM. EPIPYROPIDAE.

Heteropsyche	
poecilochroma	Eurybrachyine Fulgorid.
melanochroma	Supposedly on many genera of Jassids and Fulgorids, but it is not certain that the moths were really all one species.

Parasite	*Host*
micromorpha	Thanatodictya hebe.
dyscrita	Aphanophantia cuscuticida.
stenomorpha	See remarks under H. melanochroma above.
Agamopsyche	
threnodes	Stenocranus, Perkinsiella, and other Delphacid genera, long and short-winged adults.
Palaeopsyche	
melanias	On a commonplace Agalliine (?) found on terminal shoots of a Terminalia. No examples of this hopper seem to have been kept apart.

SUMMARY OF CONTENTS OF THIS BULLETIN.

In Parts I and X of this Bulletin the Dryinidae are discussed, their habits and structures being detailed. It is specially shown that those forms which attack Jassids, while often superficially resembling others parasitic on Delphacids, always differ essentially in the structure of the chelae from the latter. Consequently the same species or rather the same genus does not attack both of these indiscriminately. The nature of the larval sac is explained, and a similar sac is shown to exist outside the group in an anomalous insect (possibly allied to *Embolemus*) parasitic on Orthoptera. It may be added that this is also the case with some European Belytidae, which also form larval sacs on small Jassids. The economic value of Dryinidae is discussed, and the effect of hyperparasites on their utility. Some species reproduce parthenogenetically, though males occur. Sixty-two new species and fifteen new genera are described; the majority being bred specimens.

Part II deals with the parasitic Lepidoptera of the Family Epipyropidae. Their habits are given and the remarkable form of the young larva is described. One species is parthenogenetic, and no male of this is known. Six new species are described in three new genera, all having been bred from larvae.

In Part III the Stylopidae are discussed, their habits, the effect of their attack on their hosts, the frequent occurrence of a parasitic fungus in connection with their attack, the structure of larvae and adults, and their classification being detailed. Two new genera and a subgenus (*nom. praeocc.*) are described, and eight new species.

Part IV deals with the *Pipunculidae*; their habits, the form of the larvae and puparia, and the classification of the numerous species. Thirty-two new species are described; the full description of one species, however, is omitted and will be found in Pt. X. All belong to the genus *Pipunculus*, and half the whole number of species were bred.

In Part V, some predaceous enemies of leaf-hoppers are considered. The complete life-history of the earwig *Chelisoches morio*, is given, and a detailed account of the lacewing-fly, *Chrysopa microphya*, its eggs, larvae and pupa case. Two remarkable leaf-hopper-eating Syrphidae are described as new species of the genus *Baccha*.

Part VI gives an account of the Mymaridae, their habits (the life-history of *Paranagrus optabilis* being detailed) and their classification. In addition, some egg-parasites of the Proctotrupoid family Platygasteridae are dealt with. Parthenogenesis is shown to be usual in some Mymarids. Twelve new species and two new genera (one in each of the two families) are described, all being bred.

In Part VII a variety of predaceous enemies of leaf-hoppers is considered, the life-history and habits of the Locustid *Xiphidium varipenne*, being very fully given, as well as the variation in length of the tegmina. The life-histories and habits of the Coccinellidae, *Callineda testudinaria*, *Coccinella repanda*, *Verania frenata* and *V. strigula* (under the name *V. lineola*) are detailed; also those of the Hemiptera *Zelus peregrinus*, *Reduviolus blackburni*, *Triphleps persequens* and *Physopleurella mundulus*, wholly or in part. *Xiphidium varipenne* is described as a new species.

Part VIII deals with Chalcids of the families Encyrtidae, Eulophidae and Trichogrammidae, and contains remarks on habits, classification and parthenogenesis. Thirteen new genera and nineteen new species are described, all bred, some being direct, others secondary parasites.

Part IX is devoted to leaf-hoppers themselves; their habits, and what is known of their life-histories is referred to or described. The life-history of the sugar-cane leaf-hopper is given in detail, and the various stages are described. The varying condition of the flight-organs of leaf-hoppers is discussed at length. Their systematic position and classification is very fully dealt with, a survey of previous systems being given, and a criticism of these systems follows. The external structure of Homoptera is discussed at length, particular attention being paid to neuration, a synonomy of the varied terms used by different authors being given. Two hundred and thirteen new species are described, and eighty-four new genera.

Part X is supplementary to Pt. I and IV, and gives figures of structures, etc., discussed in Part I, which is without plates.

CONCLUDING REMARKS.

In the early part of this Bulletin I have referred to Mr. Koebele's work in North America in the summer of 1903. As I have pointed out, he was successful in finding there at least two species of parasites, which readily attacked the cane leaf-hopper in our cages, and broods were raised on these, and liberated in numbers in the cane fields. One of these was the species described by me as *Haplogonatopus americanus*; the other was raised in smaller numbers and none were preserved, but it was almost certainly a *Pseudogonatopus*. A great deal of time was spent in a vain endeavour to establish the Stylopid, *Elenchus*, which would most likely have proved a useful parasite, and we are now again trying by every means to introduce it from Fiji, where it attacks the Vitian cane-hopper. As to the Dryinids above mentioned, I have hopes that they may yet prove to be established, for it cannot be expected that they would increase at nearly so rapid a rate as the Mymarid egg-parasites. During the past fifteen years I have paid great attention to the rate of increase of insects imported into these islands, and collected statistics on this subject. I find that even with very prolific insects, of which several or many individuals have been introduced, it is rarely that they can be found by an entomologist for at least three years. I am now of course speaking of insects accidentally imported with plants, not those beneficial ones, which are specially reared under cover for economic purposes and distributed again and again in large numbers to many localities. I will take as an instance the Locustid, *Xiphidium varipenne*, because it is a species specially considered in this Bulletin, although it is not one of the several species, of which I know the exact date of importation. In November, 1892, a hard day's work produced two specimens of this cricket in the lower part of the Pauoa Valley; in 1893 and 1894 it was not seen. In 1895 I revisited the exact locality mentioned, and found a good many young crickets and a few old ones. In 1896 it had extended its range down into the gardens in Honolulu, but was still far from numerous. By 1900, however, it had spread all over Oahu and also reached parts of the other islands, and in many places was in incredible numbers. That is to say, a hardy and prolific insect introduced probably some years previously to 1892 took at least five years to spread over a limited area, and to become at all noticeable, but having reached this point, in the next three years it increased to such excessive numbers, that it attracted the attention of many who pay little attention to such matters, owing to the fact of its frequently swarming round the lights in houses. I have digressed to this extent to show how impossible it is to secure immediate results with *every* kind of imported beneficial insect, and also how important it is in choosing one's species to consider which can most quickly produce visible results.

From Australia and Fiji the following egg-parasites were imported: *Anagrus* (two species, or two races of one species), *Paranagrus optabilis* and *P. perforator* (the latter possibly including two species or races), *Ootetrastichus beatus.* The two ladybirds (constant inhabitants of cane-fields in Australia) *Verania strigula* and *V. frenata* were raised in large numbers and widely distributed over the islands; so too was *Callineda testudinaria*, a ready devourer of leaf-hopper in captivity, but which, I fear, will forsake the cane-fields for forest trees. *Pseudogonatopus dichromus* though not yet established, no doubt could be, since it was bred on the cane leaf-hopper in captivity. Enemies of leaf-hopper that might have been established with good results but which failed (not, I think, because they could not under any circumstances be established, but merely from mischance) were the parasitic moth *Agamopsyche*, a specific enemy of the cane leaf-hopper, the predaceous Syrphid fly *Baccha*, and some other predaceous insects, which may after all prove to be established, the time since their liberation in my opinion being too short to allow of any certainty on this point.

Although the prime object of the six months mission to Australia, undertaken by Koebele and myself, was the study of leaf-hoppers and their natural enemies, yet it must be remembered that while we were together a great deal of our time was given to various entomological studies, both to other insects injurious to cane and their natural enemies, and also to insects injurious to other vegetation. After my return to Honolulu, Mr. Koebele, I believe, turned his attention still more to pests other than leaf-hopper. Throughout the period of our Australian mission large numbers of beneficial insects not mentioned at all in this Bulletin, were collected and sent to Honolulu for the benefit of general agriculture. To publish details of all this work in full would require much time and space, and in fact a Bulletin as large or larger than the present one. We already know that some of these beneficial insects, parasitic and predaceous, are successfully established, although as yet very little special investigation of the matter has been made. I think that the introduction of almost any one of the species, that we know to have become established, would fully justify our mission.

There remains the pleasant task of thanking all those who have assisted us in our endeavour to control one of the worst insect pests these islands have yet seen. Our thanks are chiefly due to the Agents and Managers of Plantations in these islands, who have done everything possible to help us and taken much interest in our work. Especial thanks are due to Messrs. Wm. G. Irwin & Co., Ltd., and Theo. H. Davies & Co., Ltd. who by their kind offices, as representatives of the steamship lines between Honolulu and the Australian Colonies, and by letters to the officials of other steamship companies in Australia and Fiji, did much to secure for us a careful and successful transportation of the living insects. To Dr. Kottman, of the Colonial Sugar Refining Co., who on previous missions also has aided Mr. Koebele, we were indebted for letters to the Managers or owners of many sugar estates throughout Queensland and in New South Wales, and we regret that from pressure of work we were able to visit so few of these. Mr. Alexander Craw, Superintendent of Entomology under the Board of Commissioners of Agriculture and Forestry of this Territory, has given us his assistance in the handling of the beneficial insects imported, a work in which he has had a very great experience. He also, previously, as Horticultural Quarantine officer and Deputy Commissioner of the State of California, took charge of and forwarded to us the living insects despatched from Ohio by Mr. Koebele in 1903, and assisted us in like manner on former occasions. Without his expert handling, it is probable that many of these insects would have died while awaiting shipment to Honolulu. To many others, whom it is impossible to name severally, we are indebted for aid rendered, both in Australia and the United States.

DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 1

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. I. DRYINIDAE)

BY R. C. L. PERKINS

HONOLULU, H. T.
MAY 27, 1905

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HONOLULU, H. T.
MAY, 1905

LETTER OF TRANSMITTAL

To the Experiment Station Committee, Hawaiian Sugar Planters' Association.

Honolulu, T. H., April 18, 1905.

Gentlemen: I herewith submit for publication the first part of a bulletin entitled "Leaf-hoppers and their natural enemies." It will need about eight additional parts of varying length to complete this study.

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

INTRODUCTORY REMARKS

The parasites considered in this Bulletin all belong to the Dryinidae, a family of insects which, so far as is known, confine their attacks to certain groups of the Homopterous Rhynchota, popularly known as leaf-hoppers. The material which has been studied is chiefly from two sources: (1) the species observed and collected by Mr. Koebele and myself in Queensland from June till the end of December, 1904, and (2) some of the species sent to these islands from Ohio and California by Mr. Koebele in 1903; to which may be added two species peculiar to these islands. With regard to the parasites sent from Ohio and California, those which I have described below by no means include all the species sent by Mr. Koebele, and probably few or none of the rarer ones are represented. This is due to the fact that unless a considerable number of individuals were sent, I was unwilling to lose the chance of establishing a species in these islands by killing specimens for purposes of study. I now regret this fact, as had I made a critical study of these insects at that time, I should have found out what I now know, that many of the parasites sent by Mr. Koebele would not have been the least likely to accomplish the object for which they were sent, that is to attack the sugar cane leaf-hopper, since their structure is in certain respects quite different from that of those which attack leaf-hoppers of that group. From want of this knowledge much time and trouble were wasted in attempting the impossible; while several species sent, which were quite likely to attack the cane-hopper and to become established, suffered accordingly for want of attention, when this should have been entirely centered on them. The material for study that has passed through my hands, dead or alive, has been very large. Mr. Koebele sent to Honolulu from Ohio and California (but far the greater part from the former State) some three thousand cocoons, which produced several genera and many species. During the time these were being received, I bred many thousands of the Hawaiian *Echthrodelphax* for distribution in localities from which it was absent. In the six months spent in Australia, we reared a still greater number of species. Indeed when one considers that

Mr. Koebele's work in the United States was practically confined to two small areas; that nearly all our material from Australia was secured in two limited areas in Queensland, while we know that the Dryinidae are common and generally distributed in the tropics and temperate regions alike, and even occur naturally in Oceanic islands like Hawaii, it is clear that from an insignificant family with few species, this will in time become one of importance, comprising many genera and hosts of species. Particularly in Australia would the student reap a rich harvest, for it must be remembered that we were investigating these insects only during six months, and of this time only a fraction was specially devoted to them. Moreover, most of our work was done in cultivated districts, where cane is grown, or on land periodically burnt over, and greatly changed from its natural conditions, in fact such places as the entomologist bent on purely scientific research would naturally avoid. It is a remarkable fact that the student, and of course more particularly the collector of leaf-hoppers, should so rarely have noticed these parasites. One would suppose it almost impossible to collect Homoptera for a single day and not notice the conspicuous presence of the larval sac of some of the Dryinidae. They are, too, so extremely easy to breed in confinement, even under most unnatural conditions, such as in a small glass vial, that it is surprising how few have been recorded as bred.

A list of some of the later writings on this family is given below, but I have not thought it necessary to refer to those of Westwood, Walker and the old writers. References to these will be found in Ashmead's Monograph of the North American Proctotrupidae. The latter work I have studied very carefully in drawing up the characters of my new genera, and since most of the North American genera are unknown to me, and European material has not been procurable at all, I have been greatly indebted for information concerning these to the Monograph mentioned above, which includes most of the European genera.

Since that work was published, Dr. Ashmead has entirely changed his views as to the systematic position of the Dryinidae, placing them now with the true wasps, and altogether apart from the Proctotrupids. I regret that I am not at all able to follow the learned American hymenopterist in his latest views on the classification of the wasps, nor with some of his views as to the structure of certain Dryinidae, nor with his conclusions as to the significance of their chelate tarsi. These points will be discussed below.

Since the greater part of this Bulletin was written, we have received a recent paper on the raptorial front legs of the Dryinidae by Dr. J. J. Kieffer, in which figures and descriptions of these are given. The figures illustrating the present Bulletin will be published later, with those illustrating other leaf-hopper parasites.

GENERAL ACCOUNT OF THE DRYINIDAE.

LIFE HISTORY OF ECHTHRODELPHAX AS TYPICAL OF THE DRYINIDAE.

When in 1903 for the purpose of distribution in the cane-fields many hundreds of *Echthrodelphax* were kept in a cage with glass sides and large enough to contain a fair-sized growing plant of sugar cane, on which large flocks of the larvae of the cane leaf-hopper were feeding, the habits of the parasite could be studied to great advantage. By having a cage thus well stocked with the parasites, one can insure the fact that at almost any time individuals may be seen in the act of catching their prey. In such a cage, on one occasion, I counted over thirty parasites on a single cane stem each one simultaneously engaged in stinging the young hopper it had seized. When the hoppers were excreting an abundance of honey-dew, the parasites fed freely on this, but if not, some sweet liquid was supplied in place of it. Without liquid food, in a hot locality the parasites die very quickly, and the cage was freely sprinkled with water each day to advantage. Pairing of the sexes is of short duration and after copulation the male frequently never moves again, and in general dies very quickly. To watch the female parasite stalking, catching and stinging its prey, is a most interesting sight. The prey is sought on foot, for while most of the Dryinidae are most active and rapid runners, they are but poor performers on the wing. In most of the winged forms, these organs are unduly short and in *Echthrodelphax* serve hardly more than to transport it from one cane plant to another as occasion demands. As soon as the parasite becomes aware of the presence of its prey, it usually comes to a standstill, while still at a short distance; it assumes a rigid attitude comparable with that of a dog pointing game; the antennae are laid back behind the head; frequently it sidles round the hopper to gain a more advantageous position for the attack. The hoppers often show manifest uneasiness on the approach of the parasite and they hasten to remove themselves to a distance, as the latter comes to a point. In this case they are again followed up, and the performance may be repeated several times. In some cases through too great deliberation in attack the prey is entirely lost, as it moves away into concealment and the parasite fails to trace it up. Deliberate as it often is in making the attack, yet, when made, the stroke is marvelously rapid. So quickly indeed are the front legs thrown out and withdrawn that the hopper, which just now was at a distance, in an instant appears contiguous to the parasite, as if attracted by some unseen force. One pair of pincers usually grips the neck of the prey the other frequently clasps the pair of hind legs in the neighborhood of their long jumping spurs, or the abdomen towards the apex. If the hopper is unusually large and strong compared with its enemy, it not rarely manages to make its leap, and both fall to the ground together. Never however was the latter seen to relinquish its hold on the former. Its prey firmly secured and frequently held more or less crosswise to itself, the parasite now curls round the abdomen and thrusts its sting into the side of the hopper, beneath one of the wing lobes in the case of *Echthrodelphax,* and in various other positions in the case of other parasites, and the egg is deposited. The laying of the egg is again a very deliberate undertaking and the sting may remain inserted for a couple of minutes or more. Finally the sting is withdrawn, the front leg that grasps the hopper's neck is extended, the chelae or pincers fly open and the hopper is sometimes roughly jerked to a distance, sometimes more gently deposited on the plant. While grasping the hopper and inserting the sting, the parasite has been seen in some cases to freely use its mandibles on the neck in process of malaxation. After the operation, the victim usually appears weak and dazed, sometimes even lying inert on the ground, but sooner or later and sometimes very quickly, it recovers and starts feeding as if nothing had happened. Occasionally after capture, the prey is released without being stung, and it is probable that hoppers so released have already been stung by an earlier captor. Under unnatural conditions, such as in the confinement of a small jar or glass tube, and probably under pressure of hunger, the hoppers are frequently killed outright, and to some extent devoured. The position of insertion of the sting is apparently not always the same, this being sometimes inserted beneath the wing-lobe, and sometimes in the ventral side of the body, but the larval sac in either case appears beneath the wing-lobe. After the egg has been deposited, it is not for some time that the characteristic larval sac becomes evident externally. In the case of *Echthrodelphax,* I could distinguish the larval sac, having the appearance of a minute transparent vesicle, at the end of four days with the naked eye In the case of a California species of *Haplogonatopus,* the period was not less than a week. On one occasion three cane leaf-hoppers were placed in a large glass jar with the *Haplogonatopus,* and two of them were seen to be quickly seized and stung. The next day the parasite was removed to another cage. At the end of six days, when the hoppers were examined, no sign of the larval parasite was noted, even with the aid of a weak lens, and it was supposed that they were unaffected. However on the ninth day, when they were again examined, the parasitic larvae were of considerable size, and obvious to the naked eye. The third hopper of the above produced no parasite and probably was not stung. As soon as the larval sac becomes visible, it is usually but a short time, a few days or a week before the larva becomes mature. The length of time no doubt varies somewhat according to the species, and according to climatic conditions.

The larva of the *Echthrodelphax fairchildii* while still attached to the hopper, appears as a small, nearly circular, impressed, black object, adherent to the young leaf-hopper. The latter seems hardly to be inconvenienced by the parasite, remaining as active and plump as the non-parasitized individuals. It is always the immature hopper that is attacked and a single hopper may sustain one or two parasites. They are generally fixed beneath the lobes, which develop into the tegmina or upper wings, one on each side of the body, if two be present; they are, however, sometimes found beneath the true wings.

After a time, however, (always shortly before the full growth of the parasitic larva) the hopper becomes sluggish and then entirely stationary. This may happen either shortly before or not till some time after the black shell-like covering or larval sac of the parasite splits by a longitudinal (mediodorsal) fissure and exposes the back of the white maggot within. This torpidity of the leaf-hopper and the splitting of the covering of the parasite is the outward sign of a change of habits in the latter (being coincident with a moult and change of form of the parasite). From this time until the hopper dies and the maggot finally quits hold of its prey the sight as examined under a lens forms one of the most repulsive sights that natural history can afford.

Soon after the splitting of the black covering and the exposure of the white maggot, a conspicuous change takes place in the color of the latter, it becoming pink or reddish. The maggot, which has hitherto fed delicately without doing any vital injury to its host, now proceeds to ingest the contents of the hopper in an indiscriminate manner, and the change in color is clearly due to this. If removed at this time from the hopper it is seen to have very mobile and hard (chitinized) mouth parts, while the thin and collapsed black covering still adheres some distance behind the head. Growth is extremely rapid and the simultaneous shrinking of the hopper, as its contents are absorbed by the parasite, enhances this effect. Thus when the splitting of the black covering takes place the hopper may be three or four times the size of the parasite, when the latter is full fed the proportions may be exactly reversed. The removal of the contents of the hopper can be easily seen through parts of the cuticle. Generally early in the proceedings the soft contents of one or both eyes and of the head are seen to be in rapid motion, like a boiling fluid; suddenly all the pigment is removed from one eye (usually the one on the opposite side to the parasite) and it becomes an opaque white spot, then the other is often similarly destroyed, or sometimes both more or less simultaneously.

Finally the maggot, when it has finished feeding, withdraws its head, and may then sometimes be seen busily engaged in applying sticky matter from its mouth to its body. Its surface is strongly adhesive and when it quits its prey, it is able (though of course quite legless) to crawl freely over any surface, however smooth. Soon it spins a neat white cocoon, from which it emerges as an active winged insect in about 18 days.

GENERAL HABITS OF DRYINIDAE.

In Australia, the small apterous forms of the *Gonatopus* type are essentially attached to the Jassidae and Fulgoridae, that feed on grasses and low herbage, and this was also the case with the many American species sent to Hawaii by Mr. Koebele. On the other hand, the Hawaiian apterous species are essentially arboreal, but it must be remembered that in Hawaii practically all the native Homoptera are attached to forest trees, the few that live on grasses being Jassids or Fulgorids almost certainly introduced, the Hawaiian fauna being altogether of a special nature. *Echthrodelphax* is also connected with grass-eating Fulgorids, or at least with those affecting low plants. The most minute species of *Neochelogynus* attack small graminivorous Jassids. The larval sac of these small robust insects is placed ventrally on the hopper behind the posterior legs, or on the side of the neck. Most of the species of this genus, however, attack tree Jassids, and the larval sac is attached behind the posterior coxae on the ventral surface of the body. Naturally all these insects are at times met with in the adult state by sweeping grasses, but not in any considerable numbers. The apterous insects of the *Gonatopus* group can be found in some numbers by special searching about the roots of grasses in Australia, especially on sandy banks, similar to those on which I used to take *Gonatopus* itself in some numbers twenty years ago in England. The tree-frequenting winged forms are only taken rarely and singly, by beating branches of trees or shrubs, even in places where the dryinized hoppers are quite abundant, and where the mature insects can be obtained in numbers by breeding. *Paranteon* no doubt has special habits; for the sluggish hopper, that it affects, forms flocks of greater or less extent, and excreting much honey-dew, is invariably covered with swarms of ants, usually a moderate-sized species of the Formicidae. The *Paranteon* bears some slight resemblance to the ant in appearance, and this resemblance is enhanced by its actions. If a number of the parasites be bred together in a glass vial, they may be seen gathered in pairs, standing sub-erect on their four hind legs, face to face, stroking one another, licking each other's mouth, soliciting food. Now the ants, that attend the hoppers, themselves behave in similar fashion, and it is most probable that they actually feed the *Paranteon*, which unless it were on friendly terms with the ants could never approach the hoppers to lay its eggs in these. It is only necessary to touch a twig on which a colony of the hoppers rest, to see how assiduous are the ants in protecting the colony from any interference. Further, it would be interesting to note what happens to the full-grown larva of the parasite, which must emerge from its sac amongst a swarm of carnivorous ants, that are always prepared to kill and carry off any weaker insect, that falls in their way. Most probably not only are the larvae not harmed by the ants, but they may be carried down by them to their underground nest, and pupate therein. In captivity the larva forms its cocoon well beneath the soil.

All the species of the Dryinidae, which have the front legs abnormally lengthened in the females, when resting, place these in a characteristic position. The knee-joints on either side rise high above the pronotum and often are brought together so as to form a complete angular arch over the thorax. In walking, the abnormally developed claw of the chelae is always folded back on the fifth joint of the tarsus, and is not used except specially for grasping its prey. In the comparatively slender, winged insects of the genera *Neodryinus, Paradryinus* and *Chlorodryinus,* the abdomen of the females is recurved or bent on its apical part, and is always kept in this position when the insects rest, and generally when hunting their prey; and this is also the case with the large apterous *Chalcogonatopus.* When at rest they have a most extraordinary appearance for they sit sub-erect on their tail (i. e. the recurved apex of the abdomen), supported otherwise by only the two hinder pair of legs, the front pair being held in the position already described, the tarsi usually somewhat inclined, and free from the surface on which the others rest. On the other hand, the slender, winged *Echthrodelphax,* and the small wingless insects of the *Gonatopus* group, whether resting or running, hold the body segements straight, and only in the act of stinging their prey are these bent or recurved.

The short-legged, stout insects with large stigma to the front wings naturally do not exhibit the peculiarities that are shown by the species of the above named genera. Many of them, moreover, seem to be better endowed with powers of flight, the sexual disparity is much less, the males are more hardy, and, in the case of *Paranteon* at least, copulation may take place many times, in striking contrast with the feeble male of *Echthrodelphax,* which frequently drops dead within a few minutes after the act.

Although in some cases a species of the Dryinidae will attack more than one species of leaf-hopper, and indeed sometimes parasitizes species of different genera, yet in the latter case these genera always belong to the same group of hoppers. In no case have we ever found one to attack a Jassid or Fulgorid indiscriminately. Indeed from a study of structure we should suppose such a case to be impossible. Riley however is said to have bred *Labeo typhlocybae* from a *Typholocyba,* whereas this species of which the female was described as *Dryinus ormenidis,* is well known to be a common parasite of the Fulgorid genus *Ormenis,* and it might be well to confirm Riley's unique instance. Also in need of confirmation is Lichtenstein's *Gonatopus ptinorum,* said to be parasite on the beetle *Ptinus fur.*

Like other parasitic Hymenoptera some of the Dryinidae are able to reproduce their kind parthenogenetically, and probably frequently do so in a state of nature. In one case that was noticed, that of a species of *Pseudogonatopus*, of the offspring thus produced only one in forty was of the male sex.

THE ECONOMIC VALUE OF DRYINIDAE.

The parasites of the group now under consideration have until lately been considered as more or less rare insects, and therefore it is of interest to consider the extent of their economic value. A fairly true estimate of this value can be made by carefully watching some common species of leaf-hopper, which is subject to their attacks, over a considerable period of time. It must be understood that the following remarks apply to species, which are found in countries where the winters are not cold enough to put a cessation to insect activity. If we keep watch on a species of hopper from the time when its numbers are at a minimum, it will usually be observed that the individuals become more and more numerous with each generation. At first the parasite is also very scarce, or for a time may not be observed at all, but it likewise increases in number with the increase of the hopper, so that both frequently attain their greatest abundance at the same time. In the case of a common Australian species of grass eating *Liburnia* and the *Pseudogonatopus* parasitic on it, which were observed for about three consecutive months, the visibly parasitized individuals, when the hoppers were most abundant, amounted to as high as 50 per cent of the whole. Many individual hoppers carried two to four, some even six parasites. Adults and all the earlier instars were attacked alike. This statement however would give a very inaccurate idea of the true value of the parasite. Firstly, many of the apparently sound hoppers were affected by the parasite, which had not yet shown externally; secondly, an enormous proportion of them were in the young stages and incapable of breeding, and, for days or weeks to come, were liable to be parasitized before they could reach maturity. It will not therefore be surprising to learn that a few weeks after the parasites were at their maximum, the hoppers from their numerical maximum fell suddenly away to a minimum, being represented, in places where they had swarmed previously, by only scattered specimens.

It might have been expected that now the parasite would have been swarming in the locality, where so many dryinized hoppers had lately existed, the more so as, on account of their wingless condition, they would not be likely to stray far away from their birth place. This however was not the case, for just as the parasite reaches its maximum in numbers, at the same time as the hopper, so do the hyperparasites at the same time as the parasite. When the *Pseudogonatopus* was at its greaest numbers, the hyperparasites were noticed in the field in considerably greater numbers still. Of course it must also be remembered that in many cases the destruction done by the Dryinid parasite is supplemented by the work of other parasitic or predaceous insects. With the most successful hoppers (by which I mean those, which are most numerous in individuals), it would appear that at their numerical maximum, they exhibit signs of becoming a highly destructive pest, but just at this point (at any rate in normal seasons), they suddenly, owing to the attacks of parasites or predators, fall away to about their numerical minimum.

To take another instance, a common species of *Siphanta* was observed in numbers in Northern Queensland in various localities, but not so numerously as a rule as to be considered injurious to any considerable extent. On the other hand, under unnatural conditions, it showed itself capable of doing the greatest damage, for an isolated colony established on a bush in the town of Cairns where its natural enemies had little chance of finding it, had so injured the bush that the owner cut away and destroyed a large portion of it. At Townsville, on an isolated row of trees, the same species had evidently increased to great numbers prior to our visit, as could be easily seen by the appearance of the affected trees, and the empty larval skins of the Siphanta. In this case, however, the parasites had already discovered their prey, and we saw few of the latter, but the cocoons, mostly empty, of a *Neodryinus* were so numerous, that as many as 32 were picked off a single fig-leaf! Egg parasites were also at work on the few patches of eggs that we found. Indeed in most cases, it will no doubt be found that the work of the Dryinidae, admirable as it is, to a greater or less extent is supplemented by that of other predaceous and parasitic insects. In fighting a leaf-hopper pest by the importation of parasites or predators, it will no doubt be generally found necessary to make a selection of carefully chosen enemies rather than to rely on a single specific enemy, though the latter might in some cases be perfectly successful, provided its hyperparasites be carefully excluded and that none likely to attack it already exist in the country to which it is imported.

How hardly the Dryinid parasites are at times pressed by their various hyperparasites, we often observed. To cite one instance, from about fifty cocoons of several species of parasites, obtained from grass-eating Liburniae at Redlynch near Cairns, one solitary male *Echthrodelphax* alone emerged, all the rest being hyperparasitized, and similar observations were made in several localities.

In estimating the value of the Dryinidae we should note the fact that, so far as is known, a dryinized leaf-hopper may be counted as a dead hopper. In no case is it probable that it would be capable of reproduction after being stung by the parasite, and usually it dies at the moment of emergence of the larva of the latter. In one instance a very large nymph of a *Siphanta*, bearing a larva of a *Paradryinus*, after the latter left it, had sufficient strength to moult, and produced a crippled mature insect, which quickly died; but this case was quite unique. Nymphs of leaf-hoppers bearing a parasite never attempt to moult. On the other hand, where a Dryinid attacks mature leaf-hoppers, these may of course have already deposited their eggs, but such cases are probably few.

MATURE LARVAE OF DRYINIDAE.

On leaving the host, the full-grown larva* is of elongate-ovate form, pointed anteriorly when extended, the anterior segments being much narrower than the posterior, the head more or less retractile and like the mouth parts, usually very mobile. The cuticle is microscopically rugulose or corrugated, sometimes quite bare as in some *Neodryinus* and *Paradryinus*, but in *Pseudogonatopus* (at least in some species), there are several longitudinal rows of very short and widely separated bristles and a row of latero-subventral ones on each side are more developed, placed on tubercles more developed than the others. In *Neochelogynus destructor* the segments are circularly ridged and the ridges set with minute tubercles placed close together, each tubercle bearing a longish hair.

The chitinization of the head varies in different genera or species, but conspicuous always are the large mandibles. In some *Neodryinus* and *Paradryinus* these appear to have an oblique cutting edge, which is crenulate or denticulate. In *Neochelogynus* they appear to be simple and simply pointed at the apex, and at rest the tips pass one another. The upper lip or labrum is very broadly rounded or truncate at the apex and there ciliated, and often the mandibles are largely concealed beneath it. The lower lip apically is usually strongly bent upwards at an angle with the lower surface of the head. The mouth opening is large and only partially closed by the large mandibles and the maxillae, which lie beneath them. There is a single-jointed (faint indications of a secondary division may sometimes be noticed) maxillary palp, bearing a few microscopical hairs at its apex, or sometimes one more conspicuous spinose hair and some shorter ones. The head is sparingly set with hairs or bristles which differ with the species, and these distinctions possibly yield characters of generic importance.

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*The larva of Gonatopus has been fully described by Mik (see bibliographic list.

All the larvae known are very active and most of them crawl about quickly on their emergence from the sac, in search of a proper place for spinning their cocoons. Some however like *Neodryinus* pupate on, or close to, the spot at which they issue from the host. They show many differences in colour, according to the species, the majority being white or pinkish. Some however are brown and others light green. It is noteworthy that a light green larva may issue from the sac on a brown coloured Jassid, while another species from a light green Jassid may not be green at all. These colour distinctions are, I believe, constant for a species.

COCOONS OF DRYINIDAE.

The larvae of all the known species spin a compact silken cocoon, which often consists of two parts, an inner adapted to the form of the larva and an outer and wider covering. The species of *Neodryinus* further elaborate this by fixing over it a roof, formed of the greater part of the larval sac. Many of the cocoons are highly characteristic of the genus or species, and though in some the details of shape, etc., are not absolutely constant, yet in many cases the species can be immediately distinguished by an examination of the cocoons, provided that these are formed on similar substances. When found on very different surfaces there may naturally be considerable difference exhibited by cocoons even of one species. The cocoon of *Paradryinus* is elongate and cylindrical and often found on the surface of green leaves. Under these conditions the cocoon of *P. threnodes* is densely studded with round patches of epidermis stripped off from the leaf surface; that of *P. koebelei* is less densely covered, with more elongated fragments; while *P. venator* also uses roundish fragments, but the cocoon is more carinated.

The cocoon of *Chlorodryinus* is long, narrow and cylindrical and no fragments of leaf substance are woven into the surface. That of *Neodryinus* is ovate and the upper and lower walls of the marginal part are strengthened with great numbers of vertical pillars. In addition as above mentioned, the larger part of the ruptured larval sac is removed from the hopper and attached as a roof over the cocoon. This sac being of the usual circular form, when ruptured by the escaping larva, gapes open like a bivalve shell, as do those of all other Dryinidae known to us. These two valves are stretched wide open over its cocoon by the mature Neodryinus larva, and so fastened, the whole forming a subovate or subreniform roof over just so much of the whole cocoon as covers the insect within. Of what use to the genus this extra shelter may be, we cannot conjecture. It certainly does not make the cocoon less conspicuous, as do the fragments from the surface on which it pupates that of *Paradryinus*, nor yet does it keep out the spores of fungi to which both genera and some others are very liable. All the known hyperparasites attack the larva before the cocoon is made and not afterwards, so they do not enter into the question.

The cocoons of the short-legged genera, with large ovate stigma to the front wings are almost certainly under natural conditions subterranean. They are of shorter, wider form than those of the more highly evoluted group of genera; in fact, often nearly round, and are covered with particles of the soil or debris amongst which they are formed, so as to be most difficult to detect by sight.

LARVAL SAC OF DRYINIDAE.

The larval sac of the Dryinidae is of circular form, the sides being more or less compressed according to the species. The colour is frequently uniform, but in some species it is more or less, or even conspicuously, variegated. Towards the point of attachment the surface is often nearly smooth and sometimes shining, but externally more or less rugulosely sculptured. This sculpture is sometimes so well-marked and the pattern so regular, that under a strong lens the surface of the sac presents a really beautiful appearance. In some species the external rugulose portion bears short, stiff, erect, bristles. The larval sac is formed of the skin of the curled up larva together with one or more of the adherent skins of its earlier ecdyses. After a careful examination of the sacs of a large number of species, it would appear that the full number of larval moults is four (or possibly even five) but in some species the number may be reduced. At least in the case of a species of *Neodryinus* that was most closely investigated the number of ecdyses cannot be less than four (including that from larval to pupal condition) as is evident from an examination of the sac. In this genus the sac is partially removed to form a cover for the cocoon when the larva leaves its host. This cover is subovate or reniform and consists of two distinct larval skins attached to one another, longitudinally fissured at the moults and spread out valve-like, the smaller surrounded by the larger. Each of these skins is pierced by nine spiracles of which one (at the one end of the series) is indistinct in the larger skin. Besides these, one still smaller skin is left beneath the wing-lobe of the host and this is also distinctly pierced by a series of spiracles. It is possible that there is yet another smaller skin more internally placed, though this was not observed. Therefore there are at least four and possibly five moults in this species.

POSITION OF THE LARVAL SAC.

In dryinized Homoptera there is great diversity in the position of the larval sac. The position may vary in the case of a single species, or in different species of a genus, or it may be absolutely constant, and not only in a species, but apparently in all the species of a genus.

In most of the species of *Neochelogynus* the larval sac is ventral, and lies immediately behind the posterior coxa; in *N. coriaceus,* however, it is placed at the side of the neck. In *Paranteon* the larval sac is placed either dorsally or ventrally on any abdominal segment, as many as six or eight on a single individual; more rarely it has been found beneath the thorax, at the insertion of the hind coxae or on the prothorax laterally or beneath. In *Pseudogonatopus* the sac is always dorsal or dorsolateral on the abdomen and several sacs may be found on one Delphacid. In *P. stenocrani* on the nymph of *Stenocranus dorsalis* the sac stands up erect like a wheel in the middle line between the wing-pads, giving it a most extraordinary appearance. All the species of *Echthrodelphax, Paradryinus, Thaumatodryinus* and *Neodryinus* have the larval sac placed beneath one or the other wing lobe without variation. In *Eukoebeleia*, the sacs are abdominal, variously placed, often several on one host.

ABNORMAL LENGTH OF TIME SPENT IN THE COCOON.

Considering the whole number of species of Dryinidae known to us, the average length of time spent from the period of spinning the cocoon to the emergence of the mature insect, would be from two to five weeks. Consequently as the egg state and the larval stages are known to be of short duration, many generations can be produced in a year. There comes a time however when, owing to the absence of the host in a suitable stage of development for the parasite that attacks it, or for other reasons, the Dryinid itself has to assume a lengthy resting period. So far as our observations go, this resting stage in the case of the parasite always takes place when the larva has spun its cocoon and before pupation. No doubt in countries with cold winters many pass the winter months in this stage; and in warm countries this quiescent condition is liable to be assumed at any season. During the summer months in Hawaii, occasional larvae of *Echthrodelphax* assume this torpidity in the cocoon, remaining in this condition for months, though perfectly healthy; and in some of the winter months the number that remain as larvae, when others (collected at the same time and treated in the same manner) emerge after the usual period, may amount to not less than 25 per cent. There is reason to suppose that not only a lowering of temperature, but that dryness even with increased temperature, may in some cases cause this torpidity. About 2,000 cocoons of *Dryinus*, sent to Hawaii from North America by Mr. Koebele, in the early part of November, produced in Honolulu two males a few weeks after arrival, and one male a month after these. The rest remained as torpid and shrunken larvae in the cocoons for five months after they had been collected. They were then taken to a cooler and damper locality, and all that were not killed by hyperparasites produced mature insects of both sexes in a short time. A number of curious cases were noticed in Queensland. For example, a larva of a *Paradryinus* that spun up on Oct. 1st, was still in the larval state, and, as evidenced by occasional movement, alive on Dec. 12th, though much shrunken. It was then killed and preserved. Larvae of this same *Paradryinus* that formed their cocoons in numbers on Nov. 22nd, had all emerged as perfect insects before Dec. 12th. The cause of the retardation in development is not clear in this case, but that it may under certain conditions be of an advantage to the species is evident. This would especially be the case in a country subject to long droughts, when vegetation of many kinds is dried up for long periods together, during which the hosts of these parasites must almost cease to exist in a proper stage of development for their attack. It may also be of use against the attack of hyperparasites, if, as it appears, these have not the same habit of lying dormant, except of course during winter in cold countries.

COMPARATIVE STUDY OF GENERIC CHARACTERS OF DRYINIDAE.

(*a*). *The Mouth-parts.*

The mouth-parts have been largely used in the classification of the *Dryinidae* by other writers, and they are largely employed in this paper for generic differentiation, as I am convinced of their importance. Obviously the series of genera here considered may be divided into two groups (1) those with short maxillary palpi, always less than 6-jointed, and two-jointed labial palpi; (2) those with long or moderately long 6-jointed maxillary palpi, and with three-jointed labial palpi. If however, the number of joints of the palpi in several genera (not accessible to me) as given by Ashmead is correct, then this division will no longer be of the natural character it appears to be, when based on the species and genera herewith described. The only case where it may be necessary to reconsider the generic value of the number of joints in the maxillary palpi is that of *Gonatopus* (if indeed my species is truly that genus) and *Neogonatopus*. Excepting in the number of these joints, *G. australiae* and *N. dubiosus* are practically identical, and might be the same species; but in all other cases, where I have used them to distinguish allied genera, the maxillary palpi are essentially different. The maxillary palpi in the *Dryinidae* are from two-jointed to six-jointed. In all the genera with narrow elongate stigma to the front wings and with perfectly chelate, long front legs, these palpi consist of a basal part and an apical, distinguished by a natural geniculation at their meeting. The basal part consists of one or two joints; if two-jointed, the first is extremely short and sometimes even obscure. As however it is so certainly homologous in all genera, though better developed in some than in others, it must certainly be counted in all where visibly present, or in none.

It appears to me after a comparative study of the base of the palpi in other Hymenoptera, that what I here count as the basal joint is sometimes considered a true joint by authors, sometimes as a 'palpiger' or process of the maxilla. In the Dryinidae in many forms there can be no doubt that it is a true moveable joint (as can easily be seen by watching a species under the microscope, as it recovers from narcosis), and I must repeat that it is obviously homologous throughout all those genera, in which it can be at all distinguished. I have drawn the palpi of most of the genera with the aid of the camera lucida to show the basal joints, but owing to our isolation these figures cannot be reproduced before the final part of this Bulletin is completed. I may add that it does not appear that the validity of any of the genera described by me would be affected in any case. Thus it is true that leaving out this basal joint my *Chalcogonatopus* would have 5-jointed maxillary palps, which is said to be the character of *Gonatopus* proper, but then the latter has 2-jointed, the former three-jointed labial palpi.

In *Paragonatopus, Haplogonatopus* and *Epigonatopus* only, this short basal joint is apparently absent; and there is therefore only a single joint before the geniculation in these genera; which also agree in having only a single elongate apical one beyond the geniculation.

The less specialized forms with large ovate stigma *Paranteon, Prosanteon* and *Neochelogynus* agree in having six-jointed maxillary palpi, as also do *Neodryinus, Chlorodryinus* and *Paradryinus;* and all these genera have three-jointed labial palpi. With these latter genera, and in my opinion related to *Neodryinus*, though apterous, and with the thoracic structure of *Gonatopus,* must be included *Chalcogonatopus,* with its similar labial and maxillary palpi. On the other hand, *Echthrodelphax* with its short maxillary and labial palpi resembles *Pseudogonatopus* and is obviously allied to this. Indeed I should consider that the latter and the allied apterous genera have been derived from some such form as the Australian *Echthrodelphax,* while *Chalcogonatopus* has arrived at a similar general structure, quite independently, from some such form as the Australian *Neodryinus;* the apterous condition having been accompanied with similar and remarkable changes in the thorax in each case.

The mandibles in all the species examined by me are tridentate or quadridentate. The genera with largely stigmated wings have the mandibles 4-dentate in both sexes alike, but excepting the anomalous *Eukoebeleia,* all the others, where the sexes are known, have 4-dentate mandibles in the female, 3-dentate in the male.

Tabulating these results, we find:

A. Mandibles of male and female with four teeth; maxillary palpi 6-jointed, labial palpi three-jointed............. ....*Neochelogynus, Prosanteon, Paranteon.*

B. Mandibles of male 3-dentate; of female 4-dentate, maxillary palpi, 6-jointed, labial three-jointed............. ....*Neodryinus, Paradryinus, Chlorodryinus* (probably *Thaumatodryinus,* and *Chalcogonatopus.*

C. Mandibles of male 3-dentate; of female four-dentate; maxillary palpi less than six-jointed; labial palpi 2-jointed. ....*Pseudogonatopus, Paragonatopus, Haplogonatopus, Gonatopus, Neogonatopus, Pachygonatopus* and *Echthrodelphax*

So far as the Australian, American and Hawaiian material at my disposal is concerned, this is a quite natural division or classification of the genera, but the characters given by Ashmead for others, which I have not seen, will, if correct, upset this most natural arrangement. Thus the largely-stigmated genera *Anteon* and *Chelogynus* would, one would have expected, have three-jointed labial palpi and 6-jointed maxillary. In *Dryinus* with its 6-jointed maxillary palpi one would look for 3-jointed labial palps, like *Neodryinus;* and in fact *Dryinus ormenidis* Ashm. has them so, as well as quadridentate mandibles, and therefore does not enter the genus *Dryinus* at all as characterized in the Monograph of the N. A. Proctotrypidae.

Unfortunately I have not been able to investigate the males of many genera, but all those examined by me resemble the females in the number of joints of the labial and maxillary palpi, though frequently differing somewhat in the character of these joints. Should it prove that the males in the difficult series of forms resembling *Gonatopus* always agree with their females in palpal characters, their separation will be greatly facilitated.

(*b*). *The thoracic segments.*

If we take one of the more primitive chelate forms such as *Neochelogynus* and *Paranteon,* the thorax does not present any striking peculiarities. The pronotum varies in length, but its hind angles always attain the tegulae; the usual divisions remain distinct, with well defined sutures. The thorax of the males throughout the whole family in general resembles that of these females. That the males should remain in this comparatively primitive condition may at first sight seem anomalous, but it is not really so, when one considers that the great modification of parts in the females of the highly evoluted forms is obviously entirely in connection with the habit of seizing and holding their prey, and not in any way due to sexual causes, such as would influence the other sex.

Turning to one of the most specialized winged forms, such as *Neodryinus,* we observe profound modifications of the thorax and of the front legs, the latter being lengthened in all their parts in a highly abnormal manner. The pronotum is remarkably elongate and further extension forwards (even to an increase of one-third the total length) is given by the development and dorsal position of other of the prothoracic elements. The pronotum itself is much narrowed behind and unusually mobile, but in spite of its great length the posterolateral angles fail to reach and are often very remote from the tegulae.

In the apterous forms such as *Pseudogonatopus* the thoracic sclerites attain the greatest modification of all. Here the mesonotum is reduced to a small narrow bridge between the pronotum and propodeum. Ashmead (Mon. Proct. p. 82) evidently mistook the pronotum of *Gonatopus* for the mesonotum, when he says "the latter" (i. e. mesothorax) "elongate and humped at the middle and separated from the metathorax by a strong constriction." This strong constriction is the mesonotum itself; and the great sclerite in front of it (often separated by an impression into two lobes) as is easily seen by comparing it with *Neodryinus* and other winged genera, is the mobile pronotum. The small, narrow, true mesonotum is usually without division, but in some forms of these apterous insects there is a very distinct posterior or scutellar division; and in some cases the mesonotum and its scutellum can easily be removed entire from the pronotum and propodeum. In some of these apterous forms, the lateral and sternal elements of the mesonotum become entirely fused with the propodeum, and no sutures at all remain by which the divisions may be distinguished.

(*c*). *The raptorial front legs.*

If we exclude a few genera of comparatively unspecialized, or primitive form, the most striking character of the Dryinidae is the remarkable raptorial front tarsi of the females. These consist of the usual five joints, of which the fifth is always (and generally very greatly)abnormal, and together with one of the claws, which is always extraordinarily developed, forms a seizing and holding apparatus somewhat similar to that of a lobster's 'claw.'

In most of the forms one or two preceding joints are likewise somewhat modified, being more or less produced at the base beneath into a lamellate process.

In two of the genera here characterized, *Prosanteon* and *Paranteon,* the chelae are in their least specialized form, and the fifth tarsal joint is hardly abnormal, except that at the base it extends beneath the short preceding joint, and that the vestiture is somewhat modified. The strongly curved claw is simple, except for a tooth or angulation at or near the base beneath, and at rest is folded back on the fifth joint.

In all the genera with chelate tarsi the pulvillus is well-developed, the second claw is either quite small, or apparently in many forms altogether wanting; the great chelar claw being always folded back on the fifth tarsal joint when the insect walks or rests, and only extended when it is in the act of seizing the prey.

In *Neochelogynus* the chelae have advanced a stage in development. Not only is the armature or vestiture of the fifth joint often more perfect, but the point of articulation of the fourth has advanced far along the fifth, to almost, or beyond, the middle of the whole length of this joint. In consequence of this change in the point of articulation, the chelae are somewhat moveable, though still incapable of perfect forward extension. The claw of the chelae remains of the same form as in the just named genera.

In the higher genera the chelae are far more perfect. The articulation of the fourth is pushed forward nearly to the apex of the greatly elongated fifth, which lies beneath it when at rest; or, expressed in another way, there may be said to be a long free basal backward process to the fifth, the extremity of which forms with the tip of the developed claw the apex of the chelae, when these are extended. Thus when the chelae are in action the apparent apex of the fifth tarsal joint is morphologically its extreme base.

In all the higher forms dealt with in this paper the fifth tarsal joint, though differing in minor details, is in most respects similar. It is bent and somewhat dilated at its basal free extremity and there very densely armed with the curious lamellate denticles or spines, which are so striking a character of the chelae generally. Its articulation with the fourth is of such a character as to afford extreme mobility and there is also an extremely perfect articulation between it and the great claw, allowing the most rapid closing and opening of this claw.

The claw itself, forming the one-half of the chelae, is worthy of careful study. In *Pseudogonatopus, Paragonatopus* and *Haplogonatopus,* of the apterous forms, it is, except for the bent tip, nearly straight and sub-parallel-sided, and always well armed with the lamellate denticles beneath. It has always in addition a minute, but quite distinct, tooth on its lower side, very close to the tip.

In *Gonatopus, Neogonatopus, Epigonatopus, Pachygonatopus* and *Chalcogonatopus* on the other hand, this claw is more curved, subdilated basally, with its lower edge on that part sharp and slightly convexly curved and the lamellate denticles are altogether absent or very inconspicuous and ill-developed.

Echthrodelphax, Neodryinus, Paradryinus, Chlorodryinus, and *Thaumatodryinus* in all essential respects resemble *Pseudogonatopus* and the two allied apterous genera.

Thus the genera with chelate tarsi form three groups:

(1). The chelae imperfectly extensile, the claw strong and nearly evenly curved, the lower edge nearly evenly concave; not armed beneath, except sometimes with a basal angulation or projection carrying a seta. The surface of the claw has a microscopic, longitudinal rugulose sculpture.

(2). The chelae are perfectly extensile, the claw is long, slender and less evenly curved, the curvature being chiefly on the apical third or half. The claw is subdilated basally, its lower edge not forming an even curve, but it is slightly convexly rounded on the basal half; lamellate denticles are altogether wanting or are very few and ill developed and more like mere setae, and there is no distinct microscopic tooth close to the apex. An almost imperceptible angulation is sometimes seen further back from the apex of the claw under strong magnification.

(3). The chelae are perfectly extensile; the claw long and slender and well armed beneath with lamellate denticles and with a small but quite distinct tooth near the apex; it is nearly straight and parallel-sided except that the tip is bent, and its lower margin on the basal half is not at all convexly curved, nor is the claw on that part subdilated.

Of the species considered in this paper the only real exception to the above division is the remarkable new form called *Eukocbelcia*. This might form a separate division, having the chelar claw more curved, and armed apparently rather with serrations beneath, than with the ordinary lamellate structures, while the modified fifth tarsal joint also utterly lacks the usual armature and instead of being dilated at the extremity of its process is here narrowed into a curved hook.

As any one acquainted with the structure of the *Dryinida* might guess from the abnormal character of this insect, its host is of a very special form, being none other than the anomalous *Bruchomorpha.*

Returning to the three primary divisions, it should be remarked that under the first are included all the forms with short, stout front legs and with large ovate stigma to the front wings and all the many species bred are absolutely confined to leafhoppers of the Jassid family, whether arboreal or subterrestrial.

Under the second are included only apterous species of *Gonatopus* and the four genera named above in connection with it, and all these are parasitic on Jassids, whether arboreal or subterrestrial.

The third, comprises all the other genera, of all of which we have bred species, and these are attached solely to Fulgorid leafhoppers either arboreal, or subterrestrial (i. e. graminivorous).

It is interesting to note that the first division which consists of the most primitive forms of Dryinidae are attached only to the less specialized Jassidae, while the varied and highly evoluted forms included under the third are restricted to the highly specialized Fulgoridae, the second section containing comparatively a few highly evoluted but always apterous forms that still remain attached to the Jassidae. Further it will be noted that the chelar claw of the first and second divisions comprising parasites of Jassids only, is always of different form and differently armed from those of the third, which are parasites of Fulgorids, and as far as our researches go, a Jassid parasite can immediately be distinguished from that of a Fulgorid by an examination of the claw alone.

THE NATURAL POSITION OF THE DRYINIDAE.

The Dryinidae are treated by Ashmead in his later classifications as a sub-family of the Bethylidae, the latter being included in the super-family Vespoidea. In placing the insects in the Aculeate series he reverts to Haliday's classification of 1839, while in his Monograph of the North American Proctotrupidae (1893) he agreed with Westwood and Forster in placing them in the Proctotrupids, seeing a relationship with the Ceraphroninae, which are still left in the Proctotrupidae.

The super-family Vespoidea of Ashmead appears to me an unnatural assemblage of forms, and by no means comparable with, or equivalent to, the very natural series comprised under the Apoidea and Sphegoidea. It is very doubtful whether the old classification into Anthophila, Fossores and Diploptera is any way improved by the severance of one main division of the Fossores and by its addition to the Diploptera, to which are also added the Bethylidae, Dryinidae and Chrysididae, etc., to form a super-family.

If we examine the characters laid down for the separation of the super-family Vespoidea, we find that this depends on the fact of the "pronotum extending back to the tegulae, or the latter absent." Yet in great numbers of winged female Dryinids the pronotum does not extend back to these, and in great numbers of the Chrysididae the hind angles of the pronotum not only do not attain, but are quite remarkably distant from, the tegulae.

As therefore the Bethylidae (incl. Dryinidae) and the Chrysididae do not fall naturally into one great super-family with the Vespidae, and can only be placed therein by disregarding the characters assigned to the Vespoidea, it seems to me better to recognize this fact. Of course by employing alternatives, such as the character of the abdominal segments, etc., for the Chrysididae and the chelate tarsi of the Dryinidae, these families might be made to fit in the Vespoid series, or anywhere else for that matter, yet such a procedure will hardly carry conviction to the majority of hymenopterists.

To me the Dryinidae together with the allied Bethylidae and the small and little known sub-family Emboleminae* of Ashmead (which may probably be merged in one or other of these) constitute a natural group, synthetic between the old Fossorial series of the Aculeata and the true Proctotrupidae; while the Chrysididae also constitute a group apart, which cannot be rightly merged in the Bethylid series, nor yet in the Aculeata.

Dr. Ashmead considers the Dryinidae as "evidently an ancient phylogenetic type of the order, the chelate anterior tarsi in the females being found in no other group afong the Hymenoptera" (Mon. N. A. Proct. p. 81). I am unable to see in what possible way the remarkable and highly evoluted form of the front legs can in any way affect this matter, for, surely, it has no phylogenetic significance, being in no way homologous with the chelate legs of other orders of insects. Moreover, in existing species of the Dryinidae we can clearly see how the highly modified chelate tarsus of such a form as *Dryinus* or *Gonatopus* has arisen within the limits of the family from the simple non-chelate tarsus of such a form as *Aphelopus.* It is from these simple forms that the affinities of the Dryinidae must be judged.

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* My knowledge of this sub-family is acquired from Ashmead's standard work on the Proctotrupids of North America, and from an undescribed insect which I refer to this group, though its structures will necessitate changes in the characters assigned to the Emboleminae. The larva is an external parasite of small crickets of the genus Trigonidium or allied forms, and like the Dryinidae leaves the several larval skins behind, as a ruptured sac, after the penultimate larval ecdysis.

SYSTEMATIC ACCOUNT OF THE DRYINIDAE.

The following list comprises all the species specially considered in this paper, and I may add that the species first described in each new genus is to be considered as the type of that genus. It will be observed that the generic characters are all drawn up from female examples, although I have added a short table of characters that distinguish the males in a considerable number of genera. Similarly in only a few cases are the males of the various species described, in fact only in those cases, where there is no doubt whatever that they are rightly assigned to their partners. Where one sex only is described, it is always the female; where both sexes are described, that of the male always follows the description of the female. Had I cared to describe males, which cannot at present be certainly associated with their females, the list of new species would have been greatly increased, but it would have served no useful purpose to do this, since in many cases the males of species, most distinct in the other sex, are hardly separable specifically.

In the list, all species marked with an asterisk have had the mouth parts dissected and examined in balsam; others have had them, totally or partially dissected out, and examined dry; while some from their very close relationship to other species I have not thought it necessary to examine thus minutely.

PSEUDOGONATOPUS, g. nov.

1. P. kurandae, sp. nov.*
2. P. juncetorum, sp. nov.
3. P. palustris, sp. nov.*
4. P. saccharetorum, sp. nov.
5. P. dichromus, sp. nov.*
6. P. americanus, sp. nov.*
7. P. opacus, sp. nov.
8. P. stenocrani, sp. nov.*
   var. dubiosus, var. nov.

HAPLOGONATOPUS, g. nov.

9. H. apicalis, sp. nov.*
10. H. moestus, sp. nov.
11. H. americanus, sp. nov.*

PARAGONATOPUS, g. nov.

12. P. nigricans, sp. nov.*

GONATOPUS Ljung.

13. G. australiae, sp. nov.*

NEOGONATOPUS, g. nov.

14. N. ombrodes, sp. nov.*
15. N. erythrodes, sp. nov.*
16. N. obscurissimus, sp. nov.
17. N. pulcherrimus, sp. nov.
18. N. dubiosus, sp. nov.
19. N. brunnescens, sp. nov.
20. N. pallidiceps, sp. nov.

EPIGONATOPUS, g. nov.

21. E. solitarius, sp. nov.*

PACHYGONATOPUS, gen. nov.

22. P. melanias, sp. nov.*

CHALCOGONATOPUS, g. nov.

23. C. gigas, sp. nov.*
24. C. optabilis, sp. nov.*
25. C. decoratus, sp. nov.*

EUGONATOPUS, subg. nov.

26. E. pseudochromus, sp. nov.*

ECHTHRODELPHAX, Perk.

27. E. fairchildii, Perk.*
28. E. nigricollis, sp. nov.
29. E. bifasciatus, sp. nov.

Dryinus

NEOG~~ONATOPUS~~, g. nov.

30. N. koebelei, sp. nov.*
31. N. nelsoni, sp. nov.
32. N. raptor, sp. nov.
var. umbrata, var. nov.

PARADRYINUS, g. nov.

33. P. koebelei, sp. nov.*
34. P. venator, sp. nov.*
35. P. threnodes, sp. nov.
36. P. gigas, sp. nov.
37. P. leptias, sp. nov.
38. P. varipes, sp. nov.

CHLORODRYINUS, g. nov.

39. C. pallidus, sp. nov.

THAUMATO-DRYINUS, g. nov.

40. T. koebelei, sp. nov.

EUKOEBELEIA, gen. nov.

41. E. mirabilis, sp. nov.*

NEOCHELOGYNUS, g. nov.

42. N. typicus, sp. nov.
43. N. nitidus, sp. nov.
44. N. leiosomus, sp. nov.
45. N. dimidiatus, sp. nov.
46. N. nigricornis, sp. nov.*
47. N. destructor, sp. nov.*
48. N. cognatus, sp. nov.
49. N. parvulus, sp. nov.
50. N. coriaceus, sp. nov.
51. N. pallidicornis, sp. nov.

PROSANTEON, g. nov.

52. P. chelogynoides, sp. nov.*

PARANTEON, g. nov.

53. P. myrmecophilus, sp. nov.*

SYNOPSIS OF GENERA OF DRYINIDAE.

Females.

1. (41) Tarsi of front legs with the fifth joint always more or less modified and with one claw greatly developed and capable of closing back on the fifth joint, so as to form more or less perfect chelae or pincers.
2. (18) Mesonotum forming a narrow bridge or stalk between the large pronotum and propodeum. Species wingless.

3. (4) Maxillary palpi 5-jointed........ *Gonatopus Ljungh.*

4. (3) Maxillary palpi not 5-jointed.

5. (10) Chelar claw armed conspicuously with special denticles similar to those on the fifth tarsal joint beneath, its lower margin nearly straight on the basal half, not with a sharp subconvex edge.

6. (9) Pronotum with a conspicuous transverse impression before the middle, dividing it into a shorter anterior and longer posterior lobe.

7. (8) Maxillary palpi 4-jointed..........*Pseudogonatopus*

8. (7) Maxillary palpi 2-jointed............. *Paragonatopus.*

9. (6) Pronotum without a distinct transverse impression (maxillary palpi 2-jointed)........*Haplogonatopus.*

10. (5) Chelar claw more curved, usually with few or no denticles beneath, or at most with very inconspicuous ones, which are absent from the apical part, the lower edge on the more basal part slightly convexly curved, so that the claw is much less parallel-sided than that of the preceding three genera.

11. (16) Maxillary palpi not 6-jointed.

12. (15) Anterior trochanters very long, with a longish thin basal stalk; head above very distinctly concave from eye to eye.

13. (14) Maxillary palpi 4-jointed............ *Neogonatopus.*

14. (13) Maxilary palpi 2-jointed.............*Epigonatopus.*

15. (12) Anterior trochanters stout, not very elongate, widening from the base, so that there is no long narrow basal portion; head above not distinctly concave from eye to eye. (Maxillary palpi 3-jointed, the basal excessively small)...........*Pachygonatopus.*

16. (11) Maxillary palpi 6-jointed..........*Chalcogonatopus.*

17-a. (17-b.) A distinct suture or impression extending forwards from the middle coxae and dividing the propodeum from the mesothoracic elements..*Chalcogonatopus s. s.*

17-b. (17-a.) (b) No such suture visible, the propodeal and mesothoracic elements fused laterally...subg. *Eugonatopus.*

18. (2) Mesonotum of ordinary form, species fully winged or with rudimentary wings.

19. (28) Posterior lateral angles of the pronotum not nearly attaining the tegulae.

20. (21) Maxillary palpi very short, 4-jointed, basal joint very small, the entire palpi capable of being concealed within the buccal cavity; parapsidal furrows very distinct, meeting posteriorly so as to enclose a narrow elongate triangular area. . .*Echthrodelphax P.*

21. (20) Maxillary palpi long and conspicuous reaching back at least beyond the middle of the head, if laid at full length along the middle line, and generally reaching to its hind-margin or behind this.

22. (25) Vertex of head slightly concave or impressed, never convex.

23. (24) Labial palpi 2-jointed, mandibles 3-dentate, (sec. Ashmead (Mon. Proctotryp.)..........*Dryinus Latr.*

24. (23) Labial palpi 3-jointed, mandibles 4-dentate, parapsidal furrows entirely wanting............. .*Neodryinus.*

25. (22) Vertex of head not impressed or concave.

26. (27) Occipital concavity well and distinctly margined even at the sides...................... .*Paradryinus.*

27. (26) Occipital concavity with a very faint margin behind the ocelli, which fails at the sides . .*Chlorodryinus.*

28. (19) Pronotum attaining the tegulae posteriorly.

29. (32) Stigma elongate and narrow, generally lanceolate, not wide and ovate, or the wings are abbreviated and rudimentary.

30. (31) Wings fully developed, antennae extremely long and thin, filiform, head short on the vertex, more than twice as wide as long......... *Thaumatodryinus.*

31. (30) Wings minute, rudimentary (mandibles 3-dentate, maxillary palpi 6-jointed, eyes conspicuously hairy) .... *Eukoebeleia.*

32. (29) Stigma large of ovate or subovate form, and the wings fully developed.

33. (36) Fourth joint of front tarsi elongate, much longer than the third, and articulated to the fifth at a distance from the true apex (or insertion of the pulvillus) of ½ to ⅓ the length of the whole joint.

34. (35) Maxillary palpi 5-jointed; propodeum long, rounded posteriorly (sec. Ashmead Mon. Proct.).......... ....*Chelogynus Hal.*

35. (34) Maxillary palpi 6-jointed......... . .*Neochelogynus.*

36. (33) Fourth joint of front tarsi small and short, not differing much from the third, and articulated far from the true apex of the fifth, so that the latter is almost normal being only slightly produced beneath in front of its articulation with the fourth.

37. (38) Maxillary palpi 4-jointed, labial palpi 2-jointed, mandibles 3-dentate (sec. Ashmead Mon. Proct.)..... ....*Anteon Jur.*

38. (37) Maxillary palpi 6-jointed, labial palpi 3-jointed, mandibles 4-dentate.

39 (40) Antennal joints widening more or less towards the apex of the antennae; propodeum bounded by a raised line at the truncature and with a definite median area on its posterior face... ..*Prosanteon.*

40. (39) Antennae simply filiform, not at all widening towards apex; propodeum without the above characters.... ....*Paranteon.*

41. (1) Tarsi of front legs simple, not chelate.

42. (43) Apterous; maxillary palpi 4-jointed (sec. Ashmead Mon. Proct.)............... .*Mystrophorus* Forst.

43. (42) Winged; maxillary palpi 5-jointed (sec. Ashmead Mon. Proct.)....................*Aphelopus* Dalm

Males.

1. (14) Stigma not large and ovate or subovate, but narrow lanceolate; mandibles with three teeth.

2. (5) Maxillary palpi very short and inconspicuous, labial palpi two-jointed.

3. (4) Antennae sometimes long, but never extremely thin and filiform; the head not incrassate............. .... *Gonatopus* (and most of the allied genera).

4. (3) Antennae extremely thin and long, the head incrassate............................ *Echthrodelphax.*

5. (2) Maxillary palpi long and conspicuous, reaching at least to the posterior margin of the head, if laid straight back; labial palpi three-jointed.

6. (9) Ocelli in a slightly curved line on the vertex, the front ocellus, at most, a very little in front of the posterior pair.

7. (8) Basal cells not indicated by distinct nervures...*Chalcogonatopus.*

8. (7) Basal cells distinct, even though the neuration be pallid. ....*Neodryinus.*

9. (6) Ocelli in a well-marked triangle, the front one well in advance of the posterior.

10. (11) Eyes not hairy......................*Chlorodryinus.*

11. (10) Eyes distinctly hairy.

12. (13) Antennae with long flagellar joints, the third not less than four times as long as wide......*Paradryinus.*

13. (12) Antennae with short flagellar joints, the third not or hardly twice as long as its greatest width...*Eukoebeleia.*

14. (1) Stigma large, ovate or subovate, mandibles with four teeth.

15. (16) Antennae with short flagellar joints, which are not twice as long as wide.............*Neochelogynus.*

16. (15) Antennae with elongate moniliform joints, which are contracted at base and apex and fully twice as long as wide...............................*Paranteon.*

PSEUDOGONATOPUS, gen. nov.

Apterous, general form that of *Gonatopus,* the mesonotum very small and narrow, forming a stalk between the large pronotum and propodeum.

Vertex of head quite deeply concave, third joint of antennae much longer than the fourth; labial palpi two-jointed, maxillary palpi four-jointed (counting the extremely short basal joint) with two joints beyond the geniculation; mandibles with four teeth, the two inner minute. Front legs with very long, clavate trochanters, which have a long thin basal portion; fourth tarsal joint very long, several times as long as the preceding joint; claw of chelae armed beneath with special denticles similar to those beneath the modified fifth tarsal joint, bent near the apex and the lower edge with a small anteapical tooth, otherwise nearly straight and subparallel-sided, the lower margin on the basal half nearly straight, not convexly curved. Pronotum with a deep transverse impression before the middle.

Synopsis of Species of PSEUDOGONATOPUS.

1. (8) Propodeum without conspicuous pilosity.
2. (5) Propodeum ferruginous or testaceous.
3. (4) Propodeum shining, third joint of antennae not longer than the scape....................*P. dichromus.*
4. (3) Propodeum not shining; third joint of antennae longer than the scape....................*P. americanus.*
5. (2) Propodeum black (with very dense coriaceous or microscopically rugulose sculpture).
6. (7) Intermediate and posterior femora and tibiae dark, black or piceous....................*P. opacus.*
7. (6) Intermediate and posterior femora and tibiae pale, yellowish brown to testaceous.

7a. (7b) Tip of antennae conspicuously pale. .*P. stenocrani.*

7b. (7a) Tip of antennae black.....*P. dubiosus,* var. praec.

8. (1) Propodeum with conspicuous pilosity.
9. (10) Propodeal elevation strongly channeled in the middle and prominent on either side of the channel...*P. juncetorum.*
10. (9) Propodeum behind the spiracles at most a little flattened or concave, not fissured so as to form two prominences.
11. (12) Propodeum in dorsal aspect with prominent anterior lateral angles....................*P. kurandae.*
12. (11) Propodeum without prominent anterior lateral angles.
13. (14) Mesonotum conspicuously pallid ..*P. saccharetorum.*
14. (13) Mesonotum not conspicuously pallid, concolorous with the rest of the thorax or nearly so *P. palustris.*

1. *Pseudogonatopus kurandae,* sp. nov.

Brown, the abdomen black or nearly so, the face, the propodeum in front and posteriorly above the petiole, pale yellowish brown or testaceous; the two basal and the apical antennal joint quite pale, tibiae and tarsi testaceous, the front tibiae more or less brown.

Head smooth, shining, posteriorly with fine and rather long hairs, third antennal joint long and slender, fully twice as long as the second, longer than the scape and much longer than the fourth, which is greatly longer than the fifth, the latter fully twice as long as its greatest width. Pronotum very smooth and shining and with a few short hairs; propodeum smooth and shining on the anterior pale-coloured portion, behind the spiracles flattened or faintly impressed, posteriorly transversely rugose and sparsely clothed with long fine hairs; in dorsal aspect with prominent anterior lateral angles. Abdomen smooth, shining, with longish pale hairs. Length about 3 mm.

Hab. Kuranda, Queensland; bred.

2. *Pseudogonatopus juncetorum,* sp. nov.

Closely allied to the preceding and perhaps more closely to the next following species. Almost like *P. kurandae* in colour since the mesonotum is conspicuously pallid except at the base and apex, as in that species. The propodeum however, is without the prominent anterior angles and of a slightly different shape, nor does it altogether in this respect agree with P. palustris. From the latter it is readily distinguished by its colour, and it is perhaps a larger insect. Length about 3 mm.

Hab. Childers, Queensland; bred.

3. *Pseudogonatopus palustris,* sp. nov.

Piceous or castaneous, abdomen black or nearly so, two basal joints of the antennae and the apical one, as well as the face below the antennae, pale. Tibiae and tarsi more or less testaceous or brownish yellow.

In structure, sculpture and clothing almost like ***P. kurandae*** but differs in the rather different shape of the propodeum, which is less evidently flattened behind the spiracles and in dorsal aspect its lateral anterior angles are rounded off or effaced. The mesonotum is not conspicuously pale, the whole thorax being concolorous or nearly so. Length 2.5-3 mm.

Hab. Brisbane and Bundaberg, Queensland; bred.

4. *Pseudogonatopus saccharetorum,* sp. nov.

Brown or more or less piceous (the abdomen darkest) and shining. Antennae paler than in any of the preceding, sometimes with all the joints pale yellowish brown, the second and the apical then being still paler, or with the intermediate joints more or less infuscate.

Allied to the preceding several species, with which it agrees in sculpture, clothing, etc., but the propodeum is much more abruptly raised into a hump-like form, its profile forming a much stronger curve, and the summit of the hump is quite deeply fissured in the middle to form a prominence on either side. Length about 3 mm.

Hab. Hambledon, near Cairns; bred.

5. *Pseudogonatopus dichromus,* sp. nov.

Testaceous or rufotestaceous, the abdomen black or piceous, except just behind the petiole, where it is more or less pale. Antennae black, the two basal joints and the apical one more or less distinctly pale.

Head more or less shining and without definite sculpture; second joint of the antennae twice as long as wide, third joint much longer than the second, which is hardly as long as the fourth, seventh, eighth and ninth a little longer than wide. Pronotum shining, smooth, impunctate, or nearly so; propodeum shining and smooth in front; posteriorly transversely strigose, not pilose. Abdomen shining, impunctate. Length 2-3 mm.

Male. Black, the face below the antennae mostly pale, legs and antennae obscure black or fuscous, base of posterior and intermediate tibiae and their tarsi often quite pallid.

Head above the antennae very densely and finely punctate or coriaceous; second joint of the antennae ovate, short, hardly as long as the scape and very distinctly shorter than the third. Mesonotum with the parapsidal furrows obsolete or extremely faint, clothed with very short pubescence when not rubbed, very finely and indefinitely punctured; propodeum, to a large extent at least, smooth and shining, and with a shallow median longitudinal impression in front. Wings with the stigma rather light fuscous, the basal cells not defined by coloured nervures.

Hab. Redlynch near Cairns and Bundaberg, Queensland; bred.

6. *Pseudogonatopus americanus*, sp. nov.

Ferruginous, the vertex of the head dark brown or blackish, as also the abdomen, except near the base and at the apex; the face, mandibles (except the teeth) and legs testaceous. Antennae black, the two basal and more or less of the third joint, pale. Legs, with the femora especially, more or less discoloured, brownish.

Vertex of head only slightly shining; third joint of antennae very long and slender, more than twice as long as the second, the apical joint black or almost so. Pronotum not very shining, and like other parts of the thorax more or less suffused or marked with black; mesonotum in the middle paler than the rest of the thorax; propodeum very strongly raised or convex, the surface dull, but with hardly visible sculpture on the middle behind the spiracle, posteriorly transversely strigose. Abdomen smooth impunctate, apparently glabrous. Length 3-3.5 mm.

Hab. Columbus, Ohio, U. S. A. (Koebele).

Pseudogonatopus opacus, sp. nov.

Black or pitchy, the face below the antennae, the two basal joints of these more or less, the anterior tibiae and tarsi, testaceous. The posterior tarsi and part of the apical joint of the antennae more or less, pale-coloured.

Dull, the head densely and minutely sculptured, appearing punctured, as also the whole of the thorax, even the posterior face of the propodeum with this sculpture instead of the usual transverse rugosity, and without evident pilosity. Abdomen smooth and shining and bearing short pale hairs. Length 2-3 mm.

Var. a. (?immature) Paler, more pitchy than black with the hind and middle tarsi quite pale and the apical joint of the antennae much more distinctly so than in the type.

Hab. Bundaberg and Brisbane, Queensland; bred.

8. *Pseudogonatopus stenocrani*, sp. nov.

Vertex of head dark, face and occiput pale, varying from ferruginous to yellowish white. Antennae with the two basal, sometimes the third, the apical, and one or two of the preceding joints more obscurely, pale. Pronotum ferruginous or brown, often more or less suffused or marked with black; propodeum black; legs testaceous, the front femora and tibiae especially, more or less dark brown.

Head and pronotum with extremely fine hardly visible punctures, or surface sculpture; the propodeum with extremely dense microscopic sculpture, appearing like fine and dense puncturation, but due really to reticulation of the surface as in the preceding species. In profile the propodeum is not at all abruptly humped and posteriorly bears at most a few short and inconspicuous hairs. Length 2-3 mm.

Hab. Ohio, U. S. A. (Koebele).

P. stenocrani var. dubiosus var. nov.

Like the typical form in structure but without the pale tips to the antennae.

Hab. Ohio, U. S. A. (Koebele).

HAPLOGONATOPUS, gen. nov.

Mandibles, maxillary and labial palpi, and the front legs practically as in the preceding genus, but the pronotum is very different, not being divided into a transverse anterior and elevated posterior portion, being quite simply convex, and the head is much more deeply concave.

Synopsis of Species of HAPLOGONATOPUS.

1. (4) Thorax for the most part dark-coloured or black.
2. (3) Apical joint of the antennae and the mesonotum largely, pale........................*H. apicalis.*
3. (2) Apical joint of the antennae and the mesonotum dark ....*H. moestus.*
4. (1) Thorax ferruginous or testaceous, at most a little infuscate ....*H. americanus.*

1. *Haplogonatopus apicalis,* sp. nov.

Black or more or less pitchy, the face on its lower half, the two basal, and sometimes the third antennal joint more or less, the apical joint, and sometimes more or less of the preceding, the mesonotum for the most part, and the legs (which are, however, often largely brown), pale, yellow to testaceous. Pronotum and propodeum posteriorly sometimes brown.

Antennae with the third joint long and slender, about twice as long as the second, the head above with scarcely visible sculpture. Pronotum very smooth, shining; mesonotum conspicuously pale; propodeum in front of the spiracles very finely transversely rugulose, behind these smooth and shining, posteriorly more or less distinctly transversely rugulose and without evident pilosity. Abdomen smooth, shining, glabrous. Length 2-2.5 mm.

Hab. Bundaberg and Childers, Queensland; bred.

2. *Haplogonatopus moestus,* sp. nov.

Apparently identical structurally with the preceding, but the apical joint of the antennae is not pale, nor does the mesonotum differ greatly from the rest of the thorax in colour, and consequently the two forms are very easily distinguished by colour characters, which appear to be of specific importance.

Hab. The Mulgrave near Cairns, Queensland; bred.

3. *Haplogonatopus americanus,* sp. nov.

Ferruginous to testaceous in colour ,the abdomen black, or obscurely pallid, changing much during life in some individuals. The antennae black, the apical joint and the two or three basal ones pale. Head generally brown on the vertex, parts of the thorax also sometimes more or less darkened.

Head with scarcely visible sculpture; pronotum shining, the transverse impression just perceptible at least at the sides in some examples, very minutely, in fact hardly perceptibly, punctured; propodeum dull, with microscopic surface rugulosity, and not at all pilose. Abdomen smooth, glabrous. Length about 2.5 mm.

Hab. Columbus, Ohio, U. S. A. (Koebele and Swezey). Mr. Swezey was of the opinion that this species was *Gonatopus bicolor* Ashmead, but that species has the "metathorax smooth, polished." I have bred about 150 females of *H. americanus* without apparent variation.

PARAGONATOPUS, gen. nov.

Head evidently, but only lightly, concave on the vertex; third joint of antennae very long (about twice as long as the fourth in the typical species). Mandibles 4-dentate, maxillary palpi only two-jointed, one elongate joint beyond the geniculation and apparently only one before this, the extremely short basal joint, that is present in allied genera, being apparently absent. Trochanters of front legs, as well as the tarsi and claw of chelae and the form of the pronotum, etc., as in the preceding genus.

Paragonatopus nigricans, sp. nov.

Black, the face below the antennae pale, the vertex of the head usually brown, sometimes piceous or nearly black, two basal joints of the antennae entirely or largely, the third sometimes more or less, pale. Legs generally to a large extent obscure brown or piceous, all the tarsi and trochanters and the hind tibiae pale yellowish brown or testaceous, but the legs vary in colour.

Head above more or less shining, and hardly perceptibly sculptured; the antennae slender, the third joint thin and elongate, about three times as long as the second, and almost twice as long as the fourth. Pronotum shining, its posterior lobe finely punctured, the propodeum finely transversely rugose in front and posteriorly, between these parts smoother, and usually finely punctured, sometimes impunctate, not pilose. Abdomen smooth, shining, almost or quite glabrous. Length 2.5-3 mm.

Hab. Bundaberg, Queensland; bred.

? GONATOPUS Ljungh.

Mandibles 4-dentate, maxillary palpi five-jointed, the basal joint extremely short and with three joints beyond the geniculation, labial palpi two-jointed. Vertex of head deeply concave; antennae with the third joint long, slender, from one-third to one-half longer than the fourth.

Pronotum deeply impressed, so as to be divided into a transverse anterior and elongate narrow posterior lobe. Front legs with trochanters very long, clavate, with long thin basal stalk; fourth tarsal joint very long, differing not much in length from the basal one, chelar claw curved, subdilated on its basal portion, and with the lower edge slightly convexly curved, and these armed at most with a few very inconspicuous denticles or spinose hairs.

Gonatopus australiae, sp. nov.

Black, the head, the thorax excepting the propodeum, brown or ferruginous. The face generally paler than the vertex of the head, the front lobe of the pronotum sometimes dark, propodeum rarely more or less of an obscure reddish black. Scape of antennae in front quite pale, the following two joints, or one of them, sometimes more or less so, the apical joint black, the legs with pale tibiae and tarsi, the femora generally largely brown or dark.

Head very deeply concave above, smooth and shining and fringed behind with longish hairs; the antennae slender, with long thin third joint, about one and a half times as long as the fourth. Pronotum smooth and shining; mesonotum rugulose; propodeum shining, traversely rugose behind, and thinly clothed with long pale hairs. Abdomen smooth and shining, at the base with some erect pale hairs, elsewhere glabrous. Length 2-3 mm.

Hab. Bundaberg, Queensland; bred.

NEOGONATOPUS, gen. nov.

Differs from Gonatopus, as characterized above, only by the 4-jointed maxillary palpi, there being two not three joints beyond the geniculation.

Synopsis of Species.

1. (4) Propodeum without hairs, and entirely black.
2. (3) Head, neck, and anterior margin of pronotum ferruginous, or pale yellowish brown; rest of thorax and abdomen deep black...............*N. pallidiceps.*
3. (2) Head above dark brown or blackish, or largely suffused with dark colour.................*N. ombrodes*
4. (1) Propodeum with distinct erect hairs; sometimes ferruginous, wholly or in part.
5 (6) Whole thorax ferruginous; tip of antennae white.................................... ..*N. pulcherrimus.*
6. (5) Propodeum at least (and sometimes most of the thorax) more or less dark; tip of antennae not white.
7. (8) Propodeum dark brown, generally paler anteriorly; head above only lightly concave...*N. brunnescens.*
8. (7) Propodeum black; head above strongly concave.
9. (10) Whole pronotum and the neck in front of this clear ferruginous; propodeum dull, with very dense sculpture.........................*N. erythrodes.*
10. (9) Pronotum mostly black, piceous, or dark brown; if in part it is rather distinctly red or ferruginous, then the propodeum is polished and very shining.
11. (12) Abdomen on its basal face with conspicuous erect hairs; propodeum highly polished.. ..*N. dubiosus*
12. (11) Abdomen on its basal face without long erect hairs; propodeum not highly polished ..*N. obscurissimus.*

1. *Neogonatopus ombrodes,* sp. nov.

Black, the vertex of the head, and the pronotum (more or less) often piceous or brown; face and occiput yellow or ferruginous; basal two, and sometimes the third joint of the antennae more or less, pale; legs pale yellowish brown or testaceous, in parts often dark brown, variable in colour.

Head rather long, very much longer than half its width, and owing to a very minute puncturation or surface sculpture little, or not at all, shining; third joint of antennae long and slender, twice as long as the second. Pronotum with close and very fine punctures or surface sculpture; propodeum dull and very densely sculptured, appearing punctate, but probably with dense microscopical reticulate sculpture of the surface, which is hairless, or almost on. Abdomen smooth, shining, glabrous, no longish hairs basally. Length 3-3.5 mm.

Hab. Columbus, Ohio, U. S. A. (Koebele).

2. *Neogonatopus erythrodes,* sp. nov.

Ferruginous, the propodeum black, the abdomen probably black when the insect first emerges, but becoming testaceous more or less suffused with black or brown, as it grows older; head above more or less dark, the antennae black, with the three basal joints pale. All the legs yellowish-brown, or testaceous.

Head above somewhat shining, not nearly twice as wide as long; pronotum shining and with a very fine indefinite puncturation; propodeum dull, having the same dense sculpture as in the preceding species, but with the whole of the posterior face distinctly transversely rugose, and bearing scanty but distinct, erect hairs. Abdomen smooth, shining, shortly pilose. Length about 3 mm.

Hab. Columbus, Ohio, U. S. A. (Koebele).

3. *Neogonatopus obscurrissimus,* sp. nov.

Black, in parts (especially the pronotum, mesonotum and some of the leg joints) dark brown or piceous. Basal two and more or less of the third joint of the antennae, as well as all the tarsi, and more or less of the hind tibiae and femora, pale, yellowish or testaceous.

Head shining and with a sparse fringe of hairs posteriorly; pronotum smooth and shining, hardly perceptibly sculptured; propodeum in some aspects somewhat shining in some parts, above with minute dense surface scultpure, and posteriorly finely transversely rugose, and bearing evident, longish, erect hairs. Abdomen very smooth and shining, sparsely pilose. Length about 3 mm.

Hab. Columbus, Ohio, U. S. A. (Koebele).

4. *Neogonatopus pulcherrimus,* sp. nov.

Ferruginous, the abdomen black. Antennae black with the three basal, and the fourth joint more or less, testaceous, the apical one white.

Head above very smooth and shining, and fringed posteriorly; the antennae thick, the joints from the fourth on being unusually short and wide. Pronotum very smooth, and shining, the mesonotum less narrow than usual; the propodeum smooth and shining, very conspicuously pilose, and on the posterior face finely transversely rugose. Abdomen smooth, shining, at the base conspicuously pilose. Length about 3 mm.

Hab. Bundaberg, Queensland; bred.

5. *Neogonatopus dubiosus,* sp. nov.

Black, shining, head above usually dark brown or brown, the face paler; basal or two basal antennal joints pale, as also the greater part of the legs; posterior lobe of the pronotum and the mesonotum nearly always dark, black or pitchy.

Form, sculpture and clothing identical with that of *Gonatopus australiae* but with the pronotum and mesonotum nearly always, if not invariably, less red, and with only two joints beyond the geniculation of the maxillary palpi. Length 2.5-3 mm.

Hab. Bundaberg, Queensland; bred.

6. *N. brunnescens,* sp. nov.

Largely brown or yellowish-brown, the abdomen sometimes black or dark brown, sometimes sordid testaceous, variable, no doubt changing colour with age; propodeum posteriorly dark brown or pitchy. Basal two joints of the antennae and the third less clearly, as well as all the legs, pale-coloured.

Head in front view very little concave on the vertex, smooth and shining above; propodeum more or less smooth and shining, sparsely clothed with erect and not very long, bristly hairs, which extend on to the mesonotum, but are easily abraded. Abdomen smooth, shining, sparsely pilose, if not abraded. Length 2.5-3 mm.

The much less deeply concave head distinguishes this species from any other here described in this genus.

Hab. Ohio, U. S. A. (Koebele): bred.

7. *N. pallidiceps*, sp. nov.

Head, apical margin of the pronotum, and the neck in front of it, the three basal antennal joints, and all the legs, pale, yellow or ferruginous.

Head smooth, shining; pronotum also smooth and shining and extremely finely punctured; propodeum a little shining in some aspects, the whole dorsal surface with minute surface sculpture and with a few short microscopic hairs; posteriorly very finely transversely rugose. Abdomen deep black, smooth and shining. Length about 2.5 mm.

Hab. Alameda, California, U. S. A.; bred.

EPIGONATOPUS, gen. nov.

Front legs and pronotum as in the two preceding genera, but the maxillary palpi quite different, two-jointed, one long acuminate joint beyond the geniculation.

Epigonatopus solitarius, sp. nov.

Thorax ferruginous, abdomen for the most part black, legs, two basal, and more or less of the third joint of the antennae, as well as the whole face, pale, yellowish or testaceous. Front femora (except at the apex) at least, and sometimes other parts of the legs, dark brown, black or piceous. Vertex of head dark.

Head above, smooth and shining, and without definite sculpture. Pronotum smooth, minutely punctured, and more or less longitudinally rugulose; propodeum at most somewhat shining about, or before, the middle; in front with rugulose surface, and posteriorly quite distinctly, but finely transversely rugose, not pilose. Abdomen smooth, shining, without hairs. Length about 3 mm.

Hab. Bundaberg, Queensland; captured, not bred.

PACHYGONATOPUS, gen. nov.

Head with the vertex incrassate, a little impressed in the middle; in front aspect not evidently concave from the one eye-margin to the other; mandibles 4-dentate; maxillary palpi 3-jointed, the basal joint excessively short, a single elongate joint beyond the geniculation. Anterior trochanters not very elongate, clavate, thickening from close to the base, and not with a long slender stalk like all the preceding genera. Otherwise the front legs are much as in the three preceding genera, which this genus resembles also in other respects.

Pachygonatopus melanias, sp. nov.

Black, the face below the antennae, the two basal joints of these (which are however darker above), all the tibiae and tarsi, but especially the front pair, pale.

Head above, very shining, with some indefinite impressions, and a median distinct one extending forwards from the front ocellus; the face above the antennae dull and very densely and minutely sculptured. Pronotum very shining, and with indefinite puncturation; propodeum shining, the surface sculpture very delicate, appearing like dense minute puncturation, not transversely rugose, nor pilose posteriorly. Abdomen smooth and shining. Length 2-2.5 mm.

Hab. Bundaberg and Rockhampton, Queensland; bred.

CHALCOGONATOPUS, gen. nov.

Apterous, head concave above, the antennae slender and elongate, with long, thin third joint. Mandibles quadridentate; maxillary palpi with six joints, labial palpi three-jointed. Pronotum deeply, transversely impressed before the middle, to form a short wider anterior and a narrow, long, elevated, posterior division; the whole thorax in fact formed much as in *Gonatopus* and its allies. Fourth joint of anterior tarsi very long about equal to the basal one, chelar claw as in *Gonatopus.* Thorax laterally with a very distinct groove or suture running forwards from the middle coxae and marking off the propodeal and mesothoracic elements.

EUGONATOPUS subgen. nov.

A very distinct subgenus of the above, having the joints of the flagellum of the antennae less long and slender, and the propodeal and mesothoracic elements, at the sides of the thorax posteriorly, completely fused.

1. *Chalcogonatopus gigas* sp. nov.

Black, slightly aeneous, especially the abdomen, the whole body and the legs clothed with conspicuous erect hairs. Clypeus, mandibles, two basal joints of the antennae, the front tarsi except the basal joint, the front coxae and trochanters, the middle and posterior tarsi, more or less pale, yellowish or testaceous. Sometimes other parts of the legs are pale, the species being variable.

Antennae long and slender, the fourth joint much longer than the scape, the sixth three or four times as long as wide, the third conspicuously longer than the fourth. Head dull, with extremely dense, minute puncturation or surface rugulosity; the thorax with similar sculpture, the propodeum in front and posteriorly with transverse rugosity also. Abdomen very dull and with feeble scattered punctures, from which the erect hairs arise. Length 5-7 mm.

Hab. Bundaberg, Queensland; bred.

2. *Chalcogonatopus optabilis* sp. nov.

Nigroaeneous, with white pubescence, the face below the antennae, the two basal joints of the antennae, the front tibiae and tarsi, and the posterior and intermediate tarsi more or less, pale-coloured, yellowish or testaceous.

Head for the most part smooth and shining above, but near the hind-margin of the eye densely punctulate; the antennae long and slender, none of the flagellar joints being less than twice as long as wide, the scape hardly as long as the fourth antennal joint, and the third much longer than the latter. Thorax pubescent, dull, or hardly shining; the pronotum indefinitely punctured; the propodeum with excessively fine transverse rugulosity, when seen under a compound microscope, and visible with a strong lens. Abdomen with rather short, white, appressed hairs. Legs without erect hairs. Length 3-4 mm.

Hab. Bundaberg, Queensland; bred.

3. *Chalcogonatopus decoratus*, sp. nov.

Like the preceding in the nigroaeneous colour, but with the antennae rather less slender, the scape, being as long as the fourth joint. The clothing is quite different, consisting of grey tomentosity, whereas in the preceding, especially on the abdomen, the individual hairs are very apparent. The pronotum is red at the sides and posteriorly, and bears a distinct median carina; the fine sculpture of the propodeum is extremely dense. The abdomen is extremely densely and minutely punctured. Length about 3 mm.

Hab. Bundaberg, Queensland; bred.

4. *Chalcogonatopus* (*Eugonatopus*) *pseudochromus,* sp. nov.

Ferruginous or more or less testaceous, the propodeum, and head above, black or dark; basal two joints of antennae quite pale, the following less clearly so, the rest black or fuscous.

Antennae less slender than in any of the preceding, scape as long as the fourth joint, seventh, eighth and ninth not twice as long as wide. Head dull, appearing densely and minutely punctate, the pronotum with very similar sculpture; the propodeum in front and posteriorly finely transversely rugose, in the middle sculptured like the head, not pilose nor pubescent; at the sides without any suture or impression dividing off the mesopleural region. Abdomen smooth, without pubescence or pilosity, the base black, and elsewhere more or less stained with fuscous. Legs neither pilose nor pubescent. Length about 4 mm.

Hab. Columbus, Ohio. (Koebele).

ECHTHRODELPHAX P.

(Bull. I., Div. Ent., Board Agr. & For., Territory of Hawaii).

Head above concave or impressed, and the face in front view strongly transverse, of triangular shape, and very similar to that of *Neodryinus.* Ocelli in a triangle of very elongate isosceles form, the front one very distant from the two basal ones, which are near together. Maxillary palpi short, four-jointed, labial palpi two-jointed. Mandibles quadridentate. The mouth parts in fact are practically as in *Pseudo-gonatopus*, as also is the pronotum, which has a distinct transverse impression. Mesonotum wider than the pronotum, shaped like that of *Neodryinus*, and with no resemblance to that of *Gonatopus*, etc., the parapsidal furrows quite distinct, enclosing a very narrow, median, elongate, triangular area. Wings fully developed, and with the usual neuration of the group. Front legs and chelae practically as in *Pseudogonatopus.*

Male with the short palpi of *Pseudogonatopus,* etc., but the extremely long, thin, filiform antennae and the subincrassate head will easily distinguish it generically, as also from any of the other allied genera with apterous females.

Table of species of ECHTHRODELPHAX.

1. (4) Thorax entirely, or all but the pronotum, black; wings without transverse bands.
2. (3) Pronotum yellow. . . . .*E. fairchildii P.*
3. (2) Pronotum black. . . . .*E. nigricollis.*
4. (1) Thorax flavous or ferruginous; wings with two bands . . . .*E. bifasciatus.*

1. *Echthrodelphax fairchildii P.*

Male. Black, the mandibles, the scape, and often the second joint of the antennae and the legs, pale.

Antennae very long and thin, the third and fourth joints subequal, as also the following ones; scape about equal to the second joint, and these two together subequal to the third. Head with shining areas varying in different aspects. Mesonotum shining, feebly punctured, with distinct furrows enclosing a triangular space. Propodeum with reticulate rugulosity, the meshwork not very dense. Abdomen black or pitchy, shining and smooth.

The female has already been sufficiently well described.

Hab. Hawaiian Islands; formerly on Kauai and Oahu only, but has now been established on the other islands for economic reasons.

2. *Echthrodelphax nigricollis* sp. nov.

Face, occiput, basal two and several apical joints of the antennae, a median abdominal band (often discoloured after death) and the legs, pale, yellow or testaceous. Form, size and sculpture almost as in *E. fairchildii*, but distinguished at a glance by the entirely black pronotum, and the reticulation of the propodeum is apparently more dense. Length 2-2.5 mm.

Hab. Cairns, Queensland; bred.

3. *Echthrodelphax bifasciatus,* sp. nov.

Testaceous or ferruginous, abdomen black at the extreme base; wings with a transverse, dark, narrow band at the apex of the basal cells and a dark cloud or band beneath the basal portion of the radial nervure.

Antennae less slender than in the two preceding species. Head above smooth and shining. Front lobe of pronotum smooth and shining, the posterior dull, and with excessively dense and minute microscopic sculptures; mesonotum smooth and shining;

propodeum dull, very densely rugulose in front and with regular transverse wrinkles behind. Abdomen smooth and shining. Length 2-2.5 mm.

NOTE.—I have not been able to make dissections of the mouthparts of this species, but I believe it has five-jointed maxillary palpi and does not properly belong to the genus *Echthrodelphax*.

Hab. Bundaberg and Childers, Queensland; bred.

NEODRYINUS gen. nov.

Head in dorsal aspect strongly transverse, with the vertex more or less concave; in front view, of triangular shape and strongly transverse. Ocelli in an equilateral triangle. Mandibles quadridentate, the apical tooth much the longest, the two innermost very small, the second distinctly larger than these. Maxillary palpi six-jointed, the basal joint very short, the third and following joints elongate, the third thicker than the three slender joints that follow; when laid back along the middle line of the head beneath they extend at least more than half its length. Labial palpi three-jointed. Antennae with the five terminal joints somewhat thicker than the preceding ones, so as to be subclavate, the third joint much the longest, much longer than the fourth, and not less than twice as long as the scape. Pronotum elongate, deeply transversely impressed before the middle, in front conspicuously emarginate, and with the posterior angles not nearly attaining the tegulae. Mesonotum without parapsidal furrows. Postscutellum exceedingly short in the middle. Propodeum very long, subequal in length to the mesothorax and scutellum together. Legs much as in *Dryinus* Latr. the front pair being much extended, with the trochanters very elongate, many times longer than the intermediate ones, curved and clavate, the stalk long and thin; the fourth joint of the tarsi very long, third moderately long and with a basal lamella beneath, bearing spinose hairs (there are rudiments of these structures on the preceding joint); fifth, seen from above, from its basal articulation to the true apex (or point of attachment of the pulvillus) extremely short, subquadrate, but produced beneath basally into a long process, which at rest extends back to the base of the third joint, and is bent and dilated at the tip, the chelar claw greatly developed, about as long as the fifth joint with its basal prolongation, denticulate or spinulose beneath, and with a minute tooth near the apex. Front wings with two distinct basal cells and narrow elongate stigma.

Synopsis of species of NEODRYINUS.

Females.

1. (2) Head above more or less shining........*N. koebelei.*
2. (1) Head above opaque.
3. (4) Antennae black or almost so, except the four apical joints, and the front of the scape......*N. nelsoni.*
4. (3) Antennae for the most, or a large part, pale, the sixth joint alone being somewhat infuscate in most examples, sometimes those adjoining this also dark. ....*N. raptor.*

1. *Neodryinus koebelei*, sp. nov.

Black, apex of clypeus and mandibles on the apical half (excepting the teeth) whitish or pale yellow, as also is the scape of the antennae beneath; the rest of the antennae clear testaceous. Posterior and intermediate tarsi (except the dark claw-joint) and the anterior coxae and trochanters more or less testaceous; intermediate tibiae, and front tibiae and tarsi often brown or testaceous; posterior tibiae sometimes brown or piceous; claw of chelae pale yellow or white.

Face with silvery pubescence, head longitudinally rugose and more or less shining. Anterior and posterior divisions of the pronotum subobliquely or subconcentrically rugose. Mesonotum not shining, densely reticulately rugose; the propodeum not shining, densely reticulately rugose; the propodeum strongly rugose, the numerous longitudinal wrinkles connected by transverse ones so as to form a network, not less dense than that of the mesonotum. Wings pale at the base, then with a transverse smoky band extending a little beyond the apex of the second basal cell; a second smoky transverse band, with its basal side oblique outwardly, is narrower, and on the upper side starts from about the middle of the stigma; between the two bands the wing is white; beyond the second apically, it is faintly smoky. Abdomen shining, black, impunctate. Length 4-6 mm.

Male. Black, apex of mandibles and the two basal joints of the antennae beneath (more or less) ferruginous, or testaceous; front tibiae and tarsi and intermediate and posterior tarsi testaceous, apical joints of the latter more or less infuscate. Head in front, and mesonotum dull, with dense and minute surface sculpture, and clothed with short hairs; the latter still more finely sculptured than the head, the surface appearing exceedingly minutely granulated; postscutellum more or less shining in certain aspects; propodeum with close irregular or reticulate rugulosity. Abdomen smooth, shining, with very feeble indefinite punctures, and clothed with excessively short erect hairs. Stigma dark brown usually concolorous or nearly so.

Hab. Bundaberg and Townsville, Queensland. Bred.

2. *Neodryinus nelsoni,* sp. nov.

Rather like the preceding, but readily distinguished by the antennae, the flagellar joints being black, except the four apical ones. The front tarsi are black or piceous with the chelar claw pale, whitish. The legs generally are darker, sometimes all black, or with posterior tarsi reddish. The bands of the wings are rather darker, and the sculpture of the pronotum different, the posterior division of the pronotum being excessively finely regulose, while the sculpture of the anterior division rather resembles that of the posterior division of *N. koebelei.* More over, the surface of the head is quite dull, not more or less shining. Length as in the preceding.

Hab. Nelson on the Mulgrave, Queensland. Bred.

3. *Neodryinus raptor,* sp. nov.

Extremely close to *N. nelsoni,* but often superficially more like *N. koebelei,* since the antennae are often almost entirely pale, though shorter. The sixth joint however is never so clear as in the latter, and is often clouded or even black, as also frequently are some of the adjoining joints. Structurally the species resembles *N. nelsoni* and is abundantly distinct from *N. koebelei.* Length 3.5-5 mm.

Male. Differs from *N. koebelei* in the colour of the stigma, which is quite pale in the middle, this part contrasting very strongly with the dark margins; the intermediate and posterior tarsi are paler, almost white on the basal joint, and therefore there is a stronger contrast between this part and the dark fuscous or blackish apical joints. The basal joints of the antennae are darker beneath (or in front), being entirely black, or almost so.

N. raptor var *umbratus,* var. nov.

The second, third, and fourth antennal joints remain more or less dull red; the middle of the third and apex of the fourth being dark, otherwise as above. This variety or species comes nearest to *N. nelsoni*.

Hab. Bundaberg and Brisbane, Queensland. Bred.

PARADRYINUS gen. nov.

Head not concave on the vertex, and straightly (or nearly so) and distinctly margined behind the ocelli, the margin continued definitely downwards around the occipital concavity; in front view the head is triangular, and but little or not at all transverse, with the vertex slightly convex. The ocelli in a triangle, about equidistant one from another. Mandibles quadridentate, the apical tooth longest, the other three rather strong, decidedly better developed than those of *Neodryinus*. Maxillary palpi six-jointed, the four terminal joints elongated, the first of these stouter than the others and the tips reaching back to at least behind the middle and even as far as the hind margin of the head beneath. Labial palpi three-jointed. Antennae not much different from those of *Neodryinus,* the third joint being very elongate, hardly less and sometimes more than twice as long as the fourth. Pronotum long, convex, transversely constricted at the base, as long or longer than the mesonotum, its hind angles not attaining the tegulae, its anterior margin subtruncate, never distinctly emarginate as in *Neodryinus*. Mesonotum extremely convex in profile, rising up strongly and abruptly from the pronotum, in most species so strongly longitudinally rugose as to render difficult the detection of the parapsidal furrows, which, however, are present, and widely separated even at the hind margin of the mesonotum, when they are traced so far. Postscutellum of moderate length. Propodeum very long, about equal in length to the mesonotum, scutellum and postscutellum. Front legs as in *Neodryinus* but the trochanters somewhat less elongate, the basal joint of the front tarsi distinctly longer than the fourth, and the anteapical tooth of the chelar claw rather stronger.

Synopsis of species of PARADRYINUS.

Females.

1. (4) Middle and hind tibiae at the base, and the base of at least the basal joint of their tarsi, pale whitish.

2. (3) Head above, pronotum and mesonotum largely, ferruginous; sometimes however more or less clouded.............................*P. koebelei.*

3. (2) Head above, pronotum except laterally and posteriorly, and the mesonotum, black or dark coloured..................................*P. varipes.*
4. (1) Middle and hind tibiae without a pale whitish basal ring.
5. (6) Third joint of antennae uniformly ferruginous...*P. venator.*
6. (5) Third joint wholly or in part dark.
7. (8) Mesonotum between the parapsides much smoother and more shining than without these...*P. leptias.*
8. (7) Mesonotum uniformly sculptured, or almost so.
9. (10) Antennae except the second joint and base of third almost wholly ferruginous; mesonotum irregularly rugose................................*P. gigas.*
10. (9) Antennae almost wholly black; mesonotum very regularly longitudinally rugose ....*P. threnodes.*

1. *Paradryinus koebelei,* sp. nov.

Female. Head and thorax ferruginous, more or less clouded with blackish or fuscous, propodeum usually entirely black. Abdomen ferruginous, generally more or less largely obscured with brown, fuscous, or piceous suffusion. Legs ferruginous, tibiae sometimes dark brown or nearly black, the base of the intermediate and posterior pair, and of one or two of their tarsal joints, white. Antennae testaceous or ferruginous, more or less infuscate, the scape white in front; apex of clypeus and the mandibles more or less whitish.

Head with a very dense and distinct surface rugulosity or rugulose punctuation, and with a distinct median carina extending about two-thirds of the distance from the front ocellus to the base of the clypeus; the latter emarginate at the apex. Pronotum somewhat strongly subconcentrically rugose, the mesonotum more strongly longitudinally rugose; propodeum reticulately rugose. Thorax with some sparse short hairs; abdomen smooth, shining, glabrous. Wings with a wide fuscous band across the middle of the basal cells, a narrow oblique one external to the transverse median and basal nervures and entering the apex of the first basal cell; these two bands connected below; a wide band with its inner margin oblique arises beneath the stigma and extends to near the apex of the marginal cell leaving the tip of the wings white. Length 4.5-6 mm.

Male. Black, mandibles and legs testaceous or yellow. Antennae with the scape, and some of the joints of the flagellum, yellow; the true colour of these masked by the dark covering of short black hairs. Head and mesonotum dull, clothed with short erect hairs, and with a dense obscure rugulose or rugulosely punctate sculpture; propodeum irregularly or reticulately rugose. Abdomen shining, with a thin pubescence, and very indefinite, fine puncturation. Neuration mostly dark brown.

Hab. Bundaberg, Queensland; bred in large numbers.

2. *Paradryinus venator,* sp. nov.

The sculpture is similar to that of the preceding species, all the species of the genus, being subject to variability in intensity of sculpture.

Black, the clypeus and mandibles more or less, the sides and posterior margin of the pronotum, ferruginous. Legs darker than in the preceding species, often largely blackish or piceous, and with no basal white rings to the hind and intermediate tibiae and tarsi. Abdomen black. Wings banded as in *P. koebelei.* Antennae with the three basal and the basal part of the fourth joint ferruginous, the rest black, except that the apical joint may be more or less pale. Length 9 mm. but variable.

Male. Extremely like that of *N. koebelei,* but with the antennae slightly, but constantly, shorter and with only the two basal joints pale.

Hab. Bundaberg, Queensland; bred in numbers.

3. *Paradryinus threnodes.*

Extremely like the preceding in form and sculpture, but very distinct in general appearance, the clypeus and mandibles being entirely dark, or only for a small part pale, the pronotum at most only obscurely pale at the sides, and black along the upturned hind margin; the legs black, the front tibiae in part piceous or ferruginous, posterior and intermediate tarsi more or less ferruginous. Antennae black, apical joint more or less pale, the scape generally pitchy beneath. Length about 5-6 mm.

Hab. The Mulgrave near Cairns and Bundaberg, Queensland. Bred.

4. *Paradryinus gigas,* sp. nov.

Apex of clypeus, a spot at the base of the scape of antennae beneath, the second and third joints of the posterior and middle tarsi as well as the chelar claw, more or less whitish or cream-coloured.

The scape, the apical part of the third and all the following antennal joints, the mandibles more or less, the legs, and the basal segment of the abdomen, ferruginous; the front coxae above, and the front femora posteriorly, dark. Of the dark bands on the wings, the apical one is more restricted and less definite apically than that of the preceding species.

Head finely, but distinctly, longitudinally rugose; the pronotum with the subconcentric rugosity of *N. koebelei*, etc., but with the sculpture relatively finer, and the surface clothed with grey pubescence; mesonotum with a dense, irregularly rugose sculpture, as also the scutellum; propodeum reticulately rugose. Abdomen with the two basal segments smooth and shining, the following grey with appressed pubescence and densely and very finely punctate. Length about 10 mm.

Hab. Bundaberg, Queensland. A single specimen captured.

5. *Paradryinus leptias* sp. nov.

Black, the clypeus apically, the cheeks adjoining it and the mandibles, the front tibiae beneath, the front trochanters in front, the middle and hind tarsi (which however are largely infuscate) and the tip of abdomen, testaceous. Basal joint of antennae beneath, as also the apical angles of the emarginate clypeus, whitish; the second joint, and a narrow ring at the junction of third and fourth, and of the fourth and fifth, and the whole of the four apical joints, testaceous. Wings banded as in the preceding species, but with the basal and median of the three transverse smoky bands more confluent.

Head dull, very densely and minutely sculptured, appearing coriaceous, with very faint evidence of longitudinal rugulosity. Pronotum piceous or obscure ferruginous along its posterior margin, on the highly convex disc, shining, smooth, with hardly visible punctures; mesonotum dull, with dense surface sculpture, between the subparallel parapsidal furrows much smoother, and more or less shining; propodeum reticulately rugose. Abdomen smooth, shining, impunctate, second segment obscurely reddish at the sides. Length about 5 mm.

Hab. Near Cairns, a single female bred.

6. *Paradryinus varipes,* sp. nov.

Black, the two basal joints of the antennae, the face below these, the lateral and posterior margins of the pronotum more or less pale, yellow, testaceous, or ferruginous; the rest of the antennae fuscous, somewhat testaceous in parts. Legs for the most part piceous, but the base of the middle and hind tibiae with a conspicuous white ring, and their tarsi white at the base. Abdomen piceous black. Sculpture of thorax very like that of *P. koebelei,* of a similar nature, but considerably finer throughout. Length about 5 mm.

Male. Black, the two basal joints of antennae rufo-piceous, the legs pale, the posterior femora and tibiae largely dark, blackish or piceous, the intermediate also obscured in a lesser degree, the tarsi nearly white, the base of hind tibiae also pallid.

Head with a very dense, minute, coriaceous sculpture; mesonotum somewhat shining in some aspects, with an excessively minute surface sculpture and some very ill-defined fine punctures, propodeum reticulately rugose. Abdomen piceous black, shining.

Hab. On the Mulgrave near Cairns, Queensland. The male was bred, but the female captured. I believe they are rightly mated.

CHLORODRYINUS gen. nov.

Like *Paradryinus* in most respects, but differs in the fact that the extremely delicate margin of the vertex posteriorly fails towards the sides, not being continued distinctly round the sides of the occipital concavity. The maxillary palpi are very long and extended back, when fully extended along the middle line, well behind the posterior margin of the head beneath. Pronotum in profile with evenly convex outline, not of the humped form of *Paradryinus.* The mesonotum is gently convex in profile, the parapsidal furrows are distinct, crenulate, subconvergent, and fail before attaining the hind margin. Basal joint of front tarsi longer than the fourth.

Chlorodryinus pallidus, sp. nov.

Testaceous, except a spot at the extreme base of the abdomen. The body is however subject to some post-mortem discoloration. Head dull, with extremely dense and minute sculpture, hardly perceptible, except under a very strong lens. Antennae very long and slender, the third joint about twice as long as the first and second together.

Pronotum smooth and shining, the dorsal outline in profile forming a regular curve. Mesonotum dull, with very dense minute coriaceous sculpture both between and outside the parapsidal furrows; propodeum densely rugose. Abdomen smooth and shining, glabrous. Wings unbanded, nervures pale, yellow, stigma pallid. Length 4-5 mm.

Male. Black, mandibles, two basal joints of antennae, and all the legs pale, yellow or ferruginous. Head exceedingly densely, minutely and evenly, punctulate or coriaceous; mesonotum with a similar, but less even, sculpture; propodeum irregularly or reticulately rugose; abdomen smooth, shining, with only indefinite puncturation. Stigma pallid.

Hab. Kuranda and the Mulgrave, Queensland. Bred.

THAUMATODRYINUS gen. nov.

Agrees with *Neodryinus* and other genera in the structure of the front legs but differs greatly in other characters. Head in front view very strongly transverse, subquadrangular, the cheeks at the base of the mandibles sharply and prominently angled, the vertex strongly convex and subtumid. In dorsal aspect the head is very strongly transverse, more than twice as wide as long, the ocelli being placed in a nearly equilateral triangle. Mandibles with three strong teeth and a small inner one. Maxillary palpi extremely long, extending back far behind the head. Antennae filiform, very long and slender, as long or a little longer than the entire insect; third joint a little longer than the thick scape; fourth subequal to or a little longer than the third; fifth and sixth subequal, distinctly longer than the fourth, each of these two with a minute black tubercle before the middle, bearing a few very fine long hairs, quite different from the general pubescence; seventh with a similarly clothed tubercle at the middle; eighth much shorter than the seventh and with a simliar tubercle near the contracted apex; ninth as the preceding, but shorter; tenth with a tubercle at the middle and another at the apex and strongly constricted after the first tubercle; all these tubercles bearing hairs as already described. Pronotum about as long as wide, or as the mesonotum, in profile rising strongly upwards, and this curve continued by the mesonotum, its hind angles attaining the tegulae. Parapsidal furrows fine and feeble, but quite evident, subconvergent, but still widely separated at the base. Propodeum rather long, about as long as wide.

Thaumatodryinus koebelei, sp. nov.

Flavo-ferruginous, the petiole black, the fifth and all the following joints of the antennae dark. The stigma and base of radial nervure, fuscous.

Head dull, with very dense and minute, coriaceous sculpture, the clypeus smooth and shining; mesonotum dull or almost so, with sculpture similar to that of the head; scutellum somewhat shining and obscurely punctured; propodeum densely reticulately rugulose. Abdomen smooth, shining, without definite sculpture. Length about 4 mm.

Hab. Near Cairns, Queensland. Bred.

EUKOEBELEIA, gen. nov.

Head large, convex on the vertex, the sides converging behind the eyes, the latter hairy, the ocelli in a nearly equilateral triangle; the mandibles 3-dentate; the antennae with the third joint about twice as long as the second, and distinctly longer than the third. Maxillary palpi 6-jointed, labial palpi 3-jointed. Pronotum transverse, attaining the tegulae with its hind angles; mesonotum with fine, but distinct, parapsidal furrows, which are subconvergent, but still widely separated at the hind margin; prorodeum short, about as long on the dorsum as the scutellum, sharply truncate, its posterior face twice as long as the dorsal. Front legs not very long, but perfectly chelate, the fourth tarsal joint very elongate, though shorter than the basal one; fifth joint with its free extremity, which forms with one claw the tip of the chelae, not dilated and armed in the usual manner, but forming a simple curved hook; the chelar claw beneath serrately dentate. Abdomen with distinct pedicel, which is longer than wide. Wings minute, rudimentary, reaching only to the base of the abdomen, pointed at the apex.

Eukoebeleia mirabilis, sp. nov.

Dull red, the abdomen, antennae except two or three basal joints, and the propodeum black. Mandibles and legs for the most part yellowish-brown or testaceous, abdominal pedicel also pale.

Head and thorax excessively densely, minutely punctate, or coriaceous; the latter very distinctly pilose. The propodeum on the dorsal surface rugose; posteriorly, with the surface finely sculptured or granulated, and subareolate. Abdomen very smooth and shining. Length 2.5-3 mm.

Hab. Ohio, U. S. A. (Koebele); bred and captured.

NEOCHELOGYNUS gen. nov.

Of robust form. Front legs with chelate anterior tarsi, but the chelae less perfect than those of any of the preceding genera, and the legs are short, not unusually lengthened, with the femora very stout and the trochanters short.

Head subincrassate, convex, the ocelli in an isosceles triangle, much widest at the base; antennae becoming more or less wide towards the apex. Maxillary palpi six-jointed, labial palpi three-jointed. Pronotum shorter than, or scarcely subequal in length to, the mesonotum, its hind angles attaining the tegulae; mesonotum without parapsidal furrows or with these only just visible at the extreme front; propodeum as wide as long, or still shorter. Anterior tarsi with the fourth joint longish, much longer than the preceding, and about equal in length to the fifth from its basal articulation to the pulvillus, the backward prolongation of the fifth longer than the length of this joint from its basal articulation to the apex; so that the articulation is situated at about one-third of the whole length of the joint. Front wings with the radius short and straight, terminated in a knob or small thickening, or bent near the extremity. Abdomen with the basal segment greatly raised from the petiole, the basal face being on a plane strongly inclined to the dorsal surface.

Synopsis of species of NEOCHELOGYNUS.

1. (8) Wings with one or more dark clouds or bands.
2. (3) Front wings with only one smoky cloud extending beneath the stigma and marginal cell...*N. typicus*
3. (2) Front wings with cloud or band as above, and with a second band at the apex of the basal cells.
4. (5) Propodeum for a large part smooth and shining posteriorly ....*N. leiosomus.*
5. (4) Propodeum posteriorly at most slightly shining, the surface everywhere rugulose or finely-rugose.
6. (7) Propodeum with the surface finely transversely and regularly rugose posteriorly...........*N. nitidus.*
7. (6) Propodeum with the posterior surface excessively finely rugulose.......................*N. dimidiatus.*
8. (1) Wings without smoky bands or clouds.
8. (10) Antennae black.................. ....*N. nigricornis.*
10. (9) Antennae with the scape at least pale.
11. (12) Antennae entirely pale....... .....*N. pallidicornis.*
12. (11) Antennae largely black or fuscous.

13. (16) Head in front with extremely dense minute sculpture appearing coriaceous or punctulate.

14. (15) Propodeum with posterior median area defined..... ....N. *parvulus.*

15. (14) Propodeum with no definite median area........... ....N. *coriaceus.*

16. (13) Head in front with reticulate rugose sculpture, probably due to a very shallow coarse puncturation.

17. (18) Propodeum with posterior median area dull, coriaceous; flagellum of antennae mostly black........ ....N. *destructor.*

18. (17) Propodeum with the median area smoother, hardly opaque; flagellum of antennae paler, more fuscous ....N. *cognatus.*

1. *Neochelogynus typicus,* sp. nov.

Black, all the legs, except the apical joint which is darker, the antennae except the three or four apical joints, and the mandibles, ferruginous.

Head with sparse grey hairs, the face closely, shallowly rugosely punctured, on the vertex more sparsely. Mandibles strongly quadridentate. Ocelli placed more or less in foveae; third joint of antennae elongate, distinctly longer than the fourth, which is longer and much more slender than the 5th, the latter considerably longer than broad, as also are all the following: Pronotum with the hind margin smooth, in front of this with large shallow punctures; mesonotum very sparsely, finely punctured, smooth and shining, the parapsides indicated by excessively short consute lines near the anterior margin; scutellum and postscutellum impunctate or nearly. Propodeum, seen from in front, bounded by a raised line posteriorly, which is bent forwards in the middle, the surface rugose; posteriorly with a median area evidently, though not strongly defined, by raised lines; this area being smooth and shiny except on its upper portion. Abdomen smooth, impunctate; basal tooth of the chelar claw with a very long seta reaching to the apex of the claw. Wings with the nervures strong, yellow, as also the stigma which is infuscate on its margins, the radius also dark. A vague transverse cloud lies beneath the stigma and marginal cell, occupying also part of the latter. Length about 4.5 mm.

Hab. Bundaberg; one female captured.

2. *Neochelogynus nitidus,* sp. nov.

Black, mandibles except the teeth, and the antennae except the four apical joints, which are nearly entirely dark, ferruginous; the preceding joints more or less dark. Front legs brownish, paler in front, hind legs nearly entirely black or piceous. Head with the surface shining, much narrowed behind the eyes to the occiput, the face closely, coarsely and shallowly rugose—punctate; the antennae with the scape about as long as the two following joints together, third joint distinctly longer than fourth, fourth much more slender than fifth, which is nearly twice as long as wide at the apex. Pronotum and mesonotum smooth, shining, sparsely and finely punctured. Propodeum rugose in front and with a raised line as in the preceding; its posterior face with the median area subobsoletely defined, the surface quite finely, transversely rugose. Abdomen smooth, shining, the basal segment very narrow, of elongate, triangular form. Wings with a large dark cloud, with the inner side oblique, occupying most of the apical portion of the wing, from near the base of the dark stigma; a second narrow dark band crosses the wing along the region of the apex of the basal cells. Length about 4 mm.

Hab. Bundaberg, Queensland; one female captured.

3. *Neochelogynus leiosomus,* sp. nov.

Black, mandibles and five basal joints of the antennae ferruginous; front legs testaceous more or less brown, hind and middle legs nearly entirely black or piceous.

Head shining, its sides strongly convergent behind the eyes, the face shining, with coarse but extremely shallow punctures, nearly effaced and more or less running into one another, so as to be rugose; median carina fine but distinct. Antennae almost as in *N. nitidus.* Pronotum for the most part, the mesonotum, scutellum and postscutellum shining and very smooth; the mesonotum very sparsely, finelv punctured. Propodeum rugose, seen from in front with the raised line, which is produced forward in the middle, distinct; posteriorly for the most part smooth and shining, the middle area distinguishable in certain aspects, but the raised lines, which bound it, are largely obsolete. Basal abdominal segment elongate-triangular. Wings with two dark bands similar to those of the preceding species, stigma brown. Length about 4 mm.

Hab. Bundaberg, Queensland; one female bred.

4. *Neochelogynus dimidiatus,* sp. nov.

Black, the mandibles and the antennae except the four terminal joints, ferruginous; two or three joints preceding the four terminal, more or less dark in part. Front legs testaceous, more or less brown posteriorly; middle and hind legs nearly black, except the apices of the tarsal joints.

Head shining, and with coarse, shallow, subconfluent punctures; the antennae formed much as in the preceding species. Mesonotum very smooth and shining, with very sparse fine punctures; the pronotum in front with ill-defined, coarse, punctuation. Propodeum seen from in front with the usual raised line, which is however not very definite; in front of this line, finely rugose; on the posterior face still more finely sculptured, rugulose, a little shining in some aspects, the posterior median area not defined. Abdomen narrow, subcompressed, the basal segment elongate triangular. Wings as in the preceding. Length 3.5 mm.

Hab. Bundaberg, Queensland; one female bred.

5. *Neochelogynus nigricornis,* sp. nov.

Black, the front tibiae and all the tarsi testaceous, the rest of the legs brown or darkish.

Head dull or almost so, with very dense and fine rugose sculpture; antennae with the second joint long, about equal to the third, the joints becoming wider very gradually from the third, so that the fifth is not abruptly wider than the fourth; 6th, 7th and 8th joints subequal, wide, but very evidently longer than broad. Pronotum in front sculptured like the head, posteriorly more or less smooth and shining; mesonotum with extremely fine microscopic rugulosity of the surface, which prevents it from being very shining, and with a few fine and feeble punctures; in very minute examples, sometimes quite smooth and impunctate. Propodeum in front rugose, the dorsal surface posteriorly bounded by the usual raised line, sometimes broken in the middle, and not very distinct, owing to the general rugosity of the surface; posteriorly the surface with dense and fine granular or rugulose sculpture, the median area not marked out by raised lines. Wings without dark bands, neuration and stigma pale, yellow. Length 2-3.5 mm.

Hab. Bundaberg, Queensland; bred.

6. *Neochelogynus destructor,* sp. nov.

Black, the mandibles except the teeth, the two basal joints of the antennae and sometimes the third more or less, all the legs, excepting usually the front femora, ferruginous.

Female. Head with reticulate, rugose sculpture, due probably to the confluence of coarse and very shallow punctures. Antennae with the second joint fully as long as the third, fifth at its widest, much wider than the fourth, and like the sixth not much longer than its greatest width. Pronotum somewhat longitudinally rugose; the mesonotum very finely and indefinitely, sparsely punctate; propodeum with the dorsal surface short, rugose, well marked off posteriorly by a distinct raised line; posteriorly its surface dull, rugulose or granulate, the median area very distinctly marked by clear raised lines. Wings clear, neuration and stigma pale, yellow. Length 2.5-3.5 mm.

Male. Black, legs, mandibles and one or more of the basal joints of the antennae, ferruginous; usually several joints of the flagellum are more or less pale, becoming from the first more or less darkened to the apical joints, which are quite black.

Head in front with the sculpture as in the female, but much feebler and more obsolete; antennae with short, moniliform joints of subequal length, except the scape, which equals the two following together. Pronotum very short, entirely concealed, if the head be laid back; mesonotum smooth, hardly perceptibly punctured, or impunctate; propodeum finely rugose, the posterior median area, which is quite definite, coriaceous, dull. Postmarginal nervure dark and the stigma with dark margin.

Hab. Bundaberg, Queensland; bred.

7. *Neochelogynus cognatus,* sp. nov.

Differs from the preceding as follows:

The basal two joints of the antennae are clear ferruginous, the following two or three more or less sordidly so and the rest fuscous. All the legs entirely pale. The pronotum is to a large extent smooth and shining, the mesonotum very smooth with a few scattered punctures; the propodeum posteriorly within the median area is much smoother, and hardly opaque. Length about 3 mm.

Hab. Bundaberg, Queensland; bred.

8. *Neochelogynus parvulus,* sp. nov.

Black, the legs, mandibles, except the teeth, basal two joints of antennae, ferruginous or testaceous; the rest of the antennal joints fuscous or blackish; the middle and posterior femora more or less brown.

Head in front extremely finely and closely punctulate or coriaceous; antennae with the fifth joint not abruptly wider than the fourth, the second subequal to the third in length. Pronotum dull, rugulose, except along the posterior margin, the mesonotum very smooth and shining, and, like the scutellum, impunctate or nearly so; the propodeum with the dorsal face as long as scutellum and postscutellum together, and rather strongly rugose, with distinct raised line posteriorly; its posterior face dull, finely rugulose or coriaceous, and with the median area defined. Stigma dark. Length about 2 mm.

Hab. Bundaberg, Queensland, captured; and Cairns, Queensland, bred.

9. *Neochelogynus coriaceus,* sp. nov.

Black, the scape of the antennae, mandibles for the most part, and all the legs (except the more or less brown posterior and intermediate femora and the apical joints of the tarsi) ferruginous or testaceous. Most of the joints of the flagellum of the antennae more or less obscurely testaceous beneath.

Face with excessively, dense, minute surface granulation and traces of obsolete fine punctures; second joint of the antennae about equal to the third but stouter; 6th, 7th and 8th a little, but quite distinctly, longer than wide. Pronotum and mesonotum dull (except the smooth posterior margin of the former) with the same excessively dense sculpture as the face; scutellum smooth, shining; propodeum quite short on the dorsal surface and rugose, the raised line quite distinct seen from in front; on the posterior face dull and with sculpture like that of the mesonotum with no median area defined. Abdomen smooth, shining. Neuration pale, stigma with darker margin. Length 2 mm.

Hab. Redlynch, near Cairns, bred.

10. *Neochelogynus pallidicornis,* sp. nov.

Black, the antennae, all the legs and the mandibles, pale, yellowish; the teeth of the latter ferruginous. Face shining, smooth, with only feeble indefinite punctuation. Pronotum as long as the mesonotum and with microscopic coriaceous sculpture; the mesonotum and scutellum smooth, shining, impunctate or nearly so; propodeum, seen from in front, reticulately rugose and bounded by the usual raised line; posteriorly dull, very finely, microscopically granulate, and with the median area perceptibly marked out, but only feebly defined. Abdomen smooth, shining. Wings with pale nervures, stigma and radius brown or fuscous. Length hardly 2 mm.

Bab. Bundaberg, Queensland; bred.

PROSANTEON, gen. nov.

Head in front with coarse shallow puncturation, the vertex convex, the antennae with the joints becoming wider towards the apex of the flagellum, the widest hardly longer than wide; scape fully as long as the two following joints together. Mandibles quadridentate. Maxillary palpi six-jointed, labial three-jointed. Pronotum very short in dorsal aspect, being strongly deflected from behind forwards; mesonotum with the parapsidal furrows very widely separated and failing about the middle; propodeum with very well marked posterior median area. Front tarsi quite different from those of any of the preceding genera, and resembling *Paranteon;* fourth joint very small and short, not differing greatly from the third, fifth a nearly normal claw-joint, but with a very short, free, basal production beneath, which underlies the short fourth joint.

Prosanteon chelogynoides, sp. nov.

Black, the mandibles for the most part, the scape of the antennae, and all the legs nearly wholly, pale, yellow or testaceous, second joint of the antennae obscurely pale, the third very slightly so; posterior coxae black.

Head somewhat shining and with very shallow, coarse, close punctures, so that it appears feebly reticulately rugose; fifth joint of antennae a little wider than the fourth, the widening of the joints of the flagellum being very gradual. Mesonotum very smooth, shining, finely and sparsely punctured, propodeum with its dorsal surface at least as long as the scutellum, reticulately rugose and bounded by the usual raised line; its posterior face with the median area somewhat shining and very distinctly marked by raised lines, outside which it is dull and densely and finely sculptured. Wings with pale yellow neuration and stigma. Length about 3 mm.

Hab. Bundaberg, Queensland; bred.

PARANTEON gen nov.

Of robust form. Head in dorsal aspect transverse, the vertex convex, maxillary palpi 6-jointed, labial three-jointed. Antennae simple, pubescent, and with longish hairs beneath, both on the scape and the flagellum, all the joints of the latter elongate, the scape as long as the two following joints together, the fourth longer than the third, but none of the flagellar joints differ much in length. Pronotum short, evidently shorter than the mesonotum, narrowed anteriorly; the mesonotum convex, with short, widely separated parapsidal furrows; the propodeum very short, subvertical from close to its anterior margin. Front legs imperfectly chelate, the chelae being incapable of extension, the fifth joint subnormal, elongate and with only a very short free basal prolongation beneath the fourth, the chelar claw closing on it and being of about the same length and without denticles beneath; fourth joint short, subnormal, hardly longer than the preceding. Front wings with large subovate stigma. Basal segment of the abdomen with strongly marked anterior and dorsal surfaces, the former abruptly inclined to the latter and much longer than it.

Paranteon myrmecophilus, sp. nov.

Black, the head, most of the thorax and basal joint of antennae ferruginous, the postscutellum and propodeum generally black or piceous, front legs more or less brown or pitchy.

Head shining and with rather indefinite punctuation, tending to rugosity; mesonotum somewhat shining, decidedly more finely punctured than the head, and the punctures not very definite; dorsal face of propodeum very short along the middle line, not longer than the post scutellum, with very fine granulate or coriaceous sculpture and the posterior raised line obsolete or wanting; posterior face shining, excessively feebly and indefinitely rugulose, and with no median area defined. Wings with neuration and stigma dark fuscous, a faint oblique cloud beneath the stigma. Length 3-4 mm.

Male. Entirely black except the front tibiae and tarsi. Face wide, subtransverse, smooth and shining, with large shallow remote punctures; antennae submoniliform and elongate with the second joint pyriform shorter than the third; 3rd, 4th, 5th and 6th subequal, elongate, and with conspicuous, erect hairs which are as long as the width of either of these joints. Mesonotum very smooth and shining and with very few punctures; propodeum rugose in front, on its posterior face in the middle smooth and shining, but without a median area defined by raised lines. Wings very clear, the subcostal nervure and stigma dark, the median, basal and transverse median nervures quite pallid.

Hab. Bundaberg and Brisbane, Queensland; bred.

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DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 2

REPORT OF WORK
OF THE
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OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. II. EPIPYROPIDÆ)
Lepidoptera

BY R. C. L. PERKINS

HONOLULU, H. T.
JUNE 3, 1905

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LETTER OF TRANSMITTAL

Honolulu, T. H., May 22nd, 1905.

To the Experiment Station Committee, Hawaiian Sugar Planters' Association.

Gentlemen:—I herewith submit for publication the second part of a bulletin entitled "Leaf-hoppers and Their Natural Enemies."

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

INTRODUCTORY REMARKS

The first record of caterpillars parasitic upon Homoptera was that of Bowring in 1850, who discovered a Coccus-like insect on the back of one of the lantern flies, *Pyrops candelaria,* at Hong Kong. Subsequently the moth was bred, and Westwood described it as a new genus and species of the family Arctiidae, under the name of *Epipyrops anomala.* He likewise described the caterpillar and the pupa of the same insect. Since Westwood's time other species of Epipyrops have been noticed in Japan and North and Central America, but as the references to these are given below in the bibliographic list it is not necessary to specially refer to them here.

When Mr. Koebele and myself arrived at Cairns in Northern Queensland and started a systematic investigation of the enemies of leaf-hoppers, these parasitic caterpillars naturally came under our observation at the very beginning of our researches. Although so far as I know no record of their occurrence in Australia has yet been published, yet their presence was not unknown to some of the Australian entomologists. Mr. F. P. Dodd, a dealer in entomological specimens, had bred one or two species, though the most casual inspection was sufficient to show me that these were neither of the two species we had found in abundance at Cairns at that time. Mr. Henry Tryon, the Government Entomologist for Queensland, had long since found the curious cocoon of these moths in that State. In fact, they are very common insects. In the case of certain species of Delphacid leaf-hoppers at Cairns, a large percentage carried one or more of the parasitic caterpillars. Another species of the parasites affected a commonplace Jassid that lives on the leaves and shoots of a species of *Terminalia,* and the number of cocoons formed on the leaves was almost incredible. As Mr. Koebele's notes well express it, they were "in millions," and at a glance gave the leaves somewhat the appearance of being badly affected with a *Pulvinaria,* or some such scale-insect. Species also occurred at Bundaberg, and after I left Australia, Mr. Koebele found them in profusion around Sydney, where nearly a score of hoppers were found to be affected. It is therefore probable that they will be found commonly throughout Australia, and that the species are fairly numerous.

GENERAL ACCOUNT OF THE LIFE HISTORY OF EPIPYROPIDAE.

The following account is mainly taken from the study of the species I call *Agamopsyche threnodes*, it being parasitic on the sugar cane leaf-hopper and a few more or less closely allied Delphacids. This is the only species known to us, of which numbers were obtained, which is obviously parthenogenetic, no male at all having been bred. The female is sluggish, and generally commences to lay very soon after emergence. The eggs were invariably fertile, very numerous, disc-like, of small size, and laid in large numbers in a batch. In nature they were found deposited on dead grass leaves, on which the cocoons were also collected. The development of the embryo could be watched through the thin egg-shell. The imago was not studied in the field, but I bred a number of specimens of a Sydney species from cocoons sent to Honolulu by Koebele, after my own return. These were kept in a large cage over growing cane and in every way reminded me strongly of a species of *Fumea*, with which I was very well acquainted many years ago, when I confined my attention to the Lepidoptera. It was to the characters of *Fumea* that I turned, when working out the material here considered, feeling sure that the resemblance was more than superficial, and the investigation has satisfied me that such is really the case. The superficial appearance of the larva in most of its stages is admirably described by Bowring in the words "a Coccus-like insect," for the larva, and also to some extent the cocoon, of many species greatly resembles certain mealy bugs in superficial appearance. In the well-grown larva of *Agamopsyche* the head is extremely small, and retractile; the mandibles minute and usually wholly, or almost wholly, concealed beneath the labrum; and the labium is produced into a spine-like process or spinneret, directed downwards. The larva is able to let itself hang down by a silken thread, and when freed from its host was often seen to do this. The head bears a number of longish bristles, the body a few inconspicuous ones. The eyes are distinct and set on a darkly pigmented area, and so placed together on the head as to superficially resemble a simple form of compound eye on each side. The thoracic legs have a small and very sharp claw, which is abruptly bent backwards. Segmentation is deep and conspicuous, the cuticle corrugated and in life more or less thickly covered with a floury efflorescence. The third, fourth, fifth and sixth abdominal segments bear very short prolegs, which, however, are capable of further protrusion than is usually observed in preserved specimens. They are furnished with a regular circlet of hooks to the number of about 20 in large and 12 or 14 in smaller larvae. An additional terminal pair of legs or claspers very closely approximated, are imperfect, being armed with hooks only along the front side. In some species of *Heteropsyche* the hooks are much more numerous, 40 or 50 to each proleg.

One or more larvae may be seen on a single hopper, but, in some cases at least, it appears that only one of these is able to become mature. The moults take place on the hoppers' back, and one or more cast skins were frequently noticed thereon. In the case of *Agamopsyche* the caterpillars were found only on mature Delphacids. They affect both short and long winged forms alike, and either sex of the hopper. In most cases at least the parasite (unless resting or moulting) has the head turned towards the tip of the abdomen of the host. Although in many of the hoppers, that were found affected, there is no waxy excretion, such as the parasitic caterpillars have been supposed to feed on, yet it is probable that these feed largely on the sweet liquid excretion or honey-dew, which is abundantly produced at all times. This opens up the question as to whether the parasite is or is not fatal to the host. Koebele from observations made at Sydney believed that the hoppers died soon after the parasite quitted them. In some cases at least with *Agamopsyche* at Cairns, death followed quickly on the withdrawal of the full-fed caterpillar. Even immediately after this event in some specimens of a Delphacid, a collapse or distortion of the dorsal sclerites of the abdomen was obvious, and healthy hoppers included in the same jar as parasitized ones outlived the latter. It would however be premature to say that a mature hopper bearing these parasites is incapable of laying fertile eggs. In the case of species other than *Agamopsyche*, the caterpillars were observed on nymphs as well as on mature hoppers. Should the nymphs moult, it would appear probable that the parasitic caterpillar would be also discarded, but it is quite possible that the drain on the strength of the host is sufficient to prevent moulting, as is always the case with the dryinized leaf-hoppers considered in Pt. I of this Bulletin.

It is, however, the first stage or instar of the caterpillar that is most interesting, not only on account of its utter dissimilarity in appearance, when compared with the later stages, but because it considerably resembles in general appearance that first larval stage of some parasitic insects of other Orders, which more or less resembles the primitive form of insects included in the Aptera.

The newly hatched larva is very minute, in shape subcampodeiform, very long and slender, and tapering to the caudal extremity. The head and thoracic segments together form about half the whole length of the larva, and are much more bulky than the rest. The head is large and remarkable for the great, ovate, black-pigmented eye on either side, and for the character of the labium, which in lateral view is often seen forming a large downward continuation of the head, of more or less triangular shape, its pointed lower extremity being armed with a long sharp spine or spinneret. It is not, however, always thus extruded, but can be withdrawn beneath the head so as not to be seen in lateral aspect. On either side of this, on the under surface of the head, and projecting nearly straight downwards, is a longish palp-like organ with slightly dilated base, which probably carries a sense organ. Its position would suggest that it is palpal rather than antennal. The segmentation is very distinct, the thoracic legs are large and in reality very elongate for a caterpillar, if they are expanded; but in dead specimens the joints are usually folded up on one another. There are two longish joints followed by an indistinct small piece resembling an empodium, over which is a long curved spinose bristle. The second to the seventh abdominal segments inclusive bear very long ambulatory bristles, set on projections or pseudopodia; the penultimate and apical segments have shorter ones, and the apex of the abdomen two excessively long and fine downward curved hairs.

The cocoons of the Epipyropidae are white, and have a mealy appearance in most cases, as have the larvae. They exhibit much variety of form, being usually more or less ornamented with carinae or outstanding lamellae, and though there may be individual variation, yet in many cases those of different species are quite distinct. Those of the genus *Heteropsyche* are more ornamental than those of *Agamopsyche* and *Palaeopsyche*, as far as the species we collected are concerned. One extremely beautiful cocoon collected by Koebele is rosette-like, being nearly round, and with three tall vertical lamellae concentrically arranged about the more solid round centre, which itself has a central depression. The moth from this was unfortunately not bred. When the moths hatch the pupa case always remains largely emergent from the cocoon, but its posterior segments are never freed, at least under natural conditions, whether the moth produced be male or female.

CLASSIFICATION.

The parasitic moths of the genus *Epipyrops* have been placed in various families by different authors. Westwood as already mentioned assigned the typical genus to the Arctiidae, but neither the neuration nor the structure of the legs will admit of such a position. Sir George Hampson has suggested placing it in the *Heterogeneidae* (*Limacodidae*) but the neuration and other structural points, as well as the larval prolegs, exclude it. Dyar who made a critical examination of an indifferent specimen from N. America, concluded that it was a "Tineoid form not referable to the Tineidae proper." This is practically the conclusion I have myself arrived at after a careful examination of the three genera here characterized, though I much regret that I have not been able to examine *Epipyrops* itself. Briefly I consider these insects to form a distinct family most nearly related to *Fumea* and *Taleporia* of the *Tineidae* and to the *Psychidae* of the *Psychina.*

Epipyropidae, fam. nov.

Head and thorax mostly with appressed scales, sometimes more or less hairy; eyes small and widely separated in front, ocelli wanting, palpi wanting (said to be present but minute in *Epipyrops*). Antennae one-half or less, with very long ciliated bipectinations in the male, much shorter ones, not ciliated, in the female. Thorax with appressed scales or more or less hairy; legs smoothish, not hairy, middle spurs absent, apical spurs at most represented by extremely minute spines. Forewings with 1a (often absent), 1b and 1c separate; 1b sometimes furcate at base, vein 8 to tip of wing, always very closely approximated to 7 at the base, or with 7 out of it. In the Australian species here described, the cell is divided into three parts by two indistinct longitudinal veins and the apex of the cell is closed only by indistinct or obsolete discocellulars. Hindwings with vein 8 (and 7 if present) free to the base not connected with cell.

The mouth parts are so degraded that it is hard to homologize the existing structures with those of an ordinary Tineid. The slight projection densely covered with scales and visible just below the clypeus, is seen, if denuded, to be a single piece with emarginate apex, divided by a suture from a basal portion, which occupies the middle of the head beneath. This structure resembles a simple labium in many insects, but its position seems that of the base of the proboscis of ordinary moths. The labrum lies in the deep emargination of the clypeus, and no other mouth-parts are present.

SYNOPSIS OF GENERA.

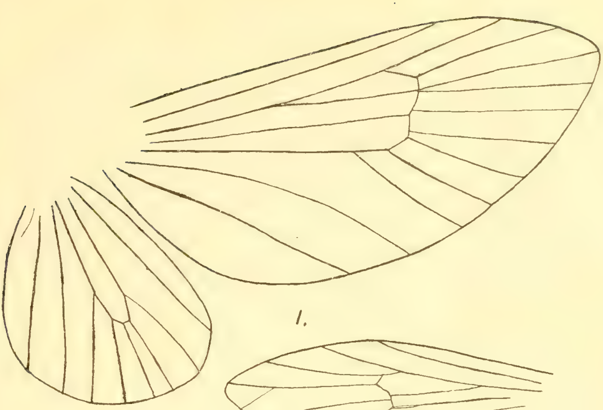
1. (2) Cell of hindwings emitting only 4 veins, (vein 4 absent) 7 free to base........................*Palaeopsyche*
2. (1) Cell of hindwings emitting 5 veins (vein 4 present) 7 absent.
3. (4) Forewings with vein 7 out of 8 near the apex...*Agamopsyche*
4. (3) Forewings with veins 7 and 8 basally approximated but distinct................................*Heteropsyche*

Palaeopsyche, gen. nov.

Forewings with 2 very distinct internal veins, vein 2 rising from cell far beyond the middle, widely separated from 3, being about as distinct from it as 3 is from 4; 7 and 8 very closely approximated at base, the cell apparently open at the apex, being only closed by obsolescent veins; vein 12 free. Posterior wings with only 6 veins in addition to the internal, vein 4 being absent; apex of cell an acute angle giving rise to vein 5 only; 7 and 8 free to the base. (Pl. fig. 3.)

Palacopysche melanias, sp. nov.

Male and female, 7-8.5 mm. Head and thorax black, somewhat hairy, antennae more or less pale, black or dark at the points of origin of the pectinations. Antennae in the male with 9 very long bipectinations, and the apex bifid to form a tenth, the longest pectination about half as long as the whole antenna;



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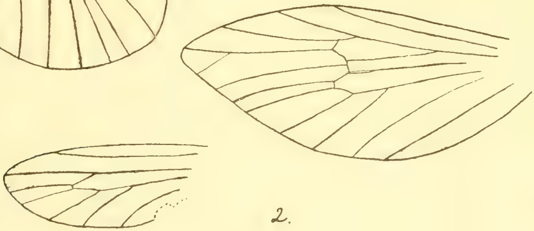

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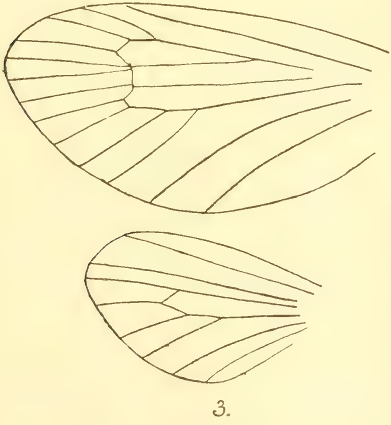

3.

DESCRIPTION OF FIGURES.

1. Neuration of fore and hind wing of Heteropsyche (female).
2. The same of Agamopsyche (female). Hind wing partly wanting.
3. The same of Palaeopsyche (male).

a short basal pectination, apparently sometimes absent. Antennae of female with much shorter bipectinations than those of the male, the longest of these twice as long as the space between itself and the next following. Anterior wings dull black, purple-tinged in some lights, shorter and broader in the male, more pointed and with very oblique termen in the female; cilia black or blackish fuscous. Hind wings dark fuscous, greyish tinged, cilia long, dark fuscous. Abdomen black, no pale anal tufts in female.

HAB. Cairns, Queensland; abundant on a Jassid on Terminalia.

Heteropsyche, gen. nov.

Differs from Palaeopsyche in that vein 9 of forewings is absent, vein 4 of hindwings is present, 7 being absent. (Pl. fig. 1). Type H. *melanochroma.*

The species of this genus are closely allied and difficult. The material at my disposal consists mostly of specimens that were allowed to die a natural death, since we wished to obtain eggs to send to the islands for economic purposes. They are therefore much abraded and practically useless for study of characters other than structural. However, either one or two examples of each species were killed while in fresh condition, and these served for the following descriptions. For the separation of the species, I have in the table used chiefly the number of pectinations of the male antennae, which appear constant in all the examples of the one species that was examined in numbers, in which I counted them. Apart from this, however, all differ in details of coloration. Koebele under number 2358 records that he found a species of *Epipyrops* on some 17 species of leaf-hoppers, Jassid and Fulgorid. I think it probable that had material of these been saved in good condition, there would have proved to have been several species of the moths under this number.

SYNOPSIS OF SPECIES.

MALES.

1. (4) Antennae with 12 pectinations on the inner side, not counting one formed by the bifid apex.
2 (3) Forewings more or less variegated; cilia of hind wings mostly white .... *H. poecilochroma*

3. (2) Forewings almost uniform blackish or blackish fuscous, cilia of hindwings dark ....*H. melanochroma*

4 (1) Antennae with less than 12 pectinations on the inner side, excluding one formed by the bifid apex.

5. (6) Forewings maculately greyish and blackish; antennae with 10 bipectinations, not counting the bifid apex.. ....*H. micromorpha*

6. (5) Forewings greyish fuscous indefinitely sprinkled or suffused with dark, antennae with 11 bipectinations (excluding that formed by the bifid apex)...*H. dyscrita*

1. *Heteropsyche poecilochroma*, sp. nov.

Male; expanse about 10 mm. Head and thorax greyish fuscous, antennae with 11 lateral bipectinations, an additional basal pectination apparently unpaired, or at least with the other of the pair scarcely visible, and the bifid apex of the antenna forming an additional pair of short pectinations; basal joint with a tuft beneath. Inner pectinations blackish with paler spots or lines, outer pale with dark tips. Forewings greyish fuscous strigulated with dark and brownish fuscous, and along the costa with black so as to have an ill-defined maculate appearance; termen slightly bowed, very oblique, dorsal margin strongly rounded; cilia dark fuscous. Hindwings dark fuscous somewhat brownish tinged, cilia except at their base white.

HAB. On the Mulgrave near Cairns, bred from a Fulgorid. (Koebele's number 2294).

2. *Heteropsyche melanochroma*, sp. nov.

Male and female; expanse about 10 mm. Head, thorax and abdomen black, or blackish fuscous. Antennae in the male with 12 bipectinations (in addition to those formed by the bifid apex) and a basal tuft beneath. Pectinations in the female very short. Forewings dull, nearly uniform, blackish fuscous or black, faintly purple tinged in some lights; hindwings blackish fuscous, hairy towards dorsum, cilia blackish fuscous.

HAB. Sydney, N. S. W. Very abundant according to Mr. Koebele. His Number 2358, which no doubt included more than one species. Said to have been bred from various Fulgorids and Jassids.

3. *Heteropsyche micromorpha,* sp. nov.

Male; expanse about 7 mm. Head and thorax dark fuscous, greyish tinged, abdomen blacker. Antennae with 10 bipectinations in addition to the bifid apex, and with a basal tuft beneath. Forewings greyish and dark blackish fuscous so arranged that the grey parts form many small roundish spots, along that costa partly blackish, cilia blackish fuscous. Hindwings blackish fuscous, cilia grey-tinged.

Hab. Sydney, N. S. W. (Koebele's number 2352) bred from a peculiar Fulgorid on fern.

4. *Heteropsyche dyscrita,* sp. nov.

Male; expanse about 9 mm. Head greyish fuscous, thorax darker, antennae with 11 bipectinations (excluding those formed by the bifid apex) and with a basal tuft beneath. Forewings greyish fuscous, indefinitely sprinkled and suffused with dark fuscous, but not so as to be definitely marked or maculate; cilia dark fuscous more or less grey-tinged at the tips. Hindwings uniform dark fuscous, cilia paler, grey-tinged.

Hab. Sydney, N. S. W. (Koebele's number 2366). Another specimen under this number looked like quite another species, but was too worn for identification. On minute Fulgorid on *Cuscuta.*

5. *Heteropsyche stenomorpha,* sp. nov.

Female; small and with narrow front wings, expanse about 8 mm. the termen very oblique, the dorsum strongly rounded. Antennal pectinations very short, the longest hardly longer than the joint that bears them. Forewings black or blackish fuscous rather roughly scaled, the cilia dark; hindwings like the front, but rather more finely scaled.

Hab. Sydney, N. S. W. (Koebele's number 2358). Might be a depauperated form of *H. melanochroma,* which bears the same number, but more probably is distinct.

Agamopsyche, gen. nov.

Differs from Heteropsyche in that vein 7 of forewings is out of 8 near the tip of the wing, and in the female the antennae are much more longly bipectinated. From Palaeopsyche it differs in the absence of vein 9 of forewings and vein 7 of hindwings. (Pl. fig. 2).

Agamopsyche threnodes, sp. nov.

Female, length 6-8 mm. Head and thorax blackish fuscous Antennae with rather long pectinations, the longest much longer than the space between itself and the next following. Forewings, long and narrow, deep black or blackish fuscous, generally with a purplish reflection, and with some obscure and variable small whitish spots; cilia greyish or greyish fuscous, conspicuously paler than the wing. Hind wings black or blackish fuscous, cilia greyish fuscous.

Hab. Cairns on Delphacids, abundant.

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DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 3

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. III. STYLOPIDÆ)

BY R. C. L. PERKINS

HONOLULU, H. T.
AUGUST 8, 1905

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LETTER OF TRANSMITTAL

Honolulu, T. H., July 14th, 1905.

Special Committee on Experiment Station,
H. S. P. A., Honolulu, T. H.

Gentlemen:

I, herewith, submit for publication the third part of the Bulletin on "Leaf-Hoppers and Their Natural Enemies."

Yours obediently,
R. C. L. PERKINS,
Director, Division of Entomology.

GENERAL REMARKS ON THE STYLOPIDAE.

The Stylopidae or Strepsiptera are minute insects of great interest on account of their anomalous structure and their remarkable parasitic habits. Even now, though they are common insects, their structures have been very imperfectly examined, and the most diverse opinions have been expressd as to their natural affinities. Sir Sydney Saunders, who monographed the group in 1872, divided them into two groups on account of their habits, viz: the Hymenopterobiae parasitic on bees, wasps, and ants, and Homopterobiae parasitic on Homoptera. The latter group was made to contain Westwood's genus *Colacina,* parasitic on a leaf-hopper from Borneo, and I believe never yet characterized. Since that time, Mr. Edward Saunders, in 1892, discovered the long known genus *Elenchus,* the host of which had been the subject of various erroneous conjectures, to be parasitic on a small leaf-hopper of the genus *Liburnia.* Two years ago Mr. Koebele bred this same insect in quantities from *Liburnia* in the State of Ohio, and subsequently in California, while in Australia we found the same to be very common in every locality which we investigated, and to attack not only *Liburnia,* but several other genera of Delphacid leaf-hoppers. Finally, Mr. Koebele, after my return to Hawaii, when he proceeded to Fiji, at once discovered *Elenchus* there in numbers, attacking various Delphacids, and we had previously found the females and male puparia in leaf-hoppers sent from those islands for our inspection. Otherwise outside Europe, a species of this genus had been collected in numbers in Mauritius by Templeton some seventy years ago. Nor is it only the Homopterous Rhynchota that are attacked, for Sharp has recorded a case of a Stylopid attacking a Pentatomid bug of the genus *Chrysocoris* from East Asia, and I had the pleasure of examining this interesting specimen, when I was last in Cambridge. We failed to find any Australian Pentatomid stylopized, though we examined considerable numbers, but as owing to pressure of other matters we were unable to make any really extensive search, it is quite probable that such will be found there. At least not only are many Fulgoridae and Jassidae affected with these parasites at all points investigated, from Sydney in New

South Wales to Cairns in Northern Queensland, but so too are the Aculeate Hymenoptera, both the Vespidae (Polistes, etc.) and many Fossores, such as the common, house-frequenting *Pelopoeus* of the Sphegidae, the Bembecidae, Stizidae, and no doubt many others.

It is but rarely that any of the male Stylopidae are met with on the wing, and consequently they appear to be rarely well represented in collections of Coleoptera; but they are so easily bred and in reality so common everywhere that our want of knowledge of their habits and structure is astonishing, when we consider how remarkable these are. On account of their larger size, the Stylopidae that are parasitic on bees and wasps, are in some ways more suitable for study than those on Homoptera. My experience of the bee parasites has been far more extensive than with the Rhynchotal ones, as I have found them everywhere in England, very abundant in bees in California, common in Arizona, and Mexico, casually noticed them at Washington and rather commonly in *Halictus* at Montreal. To their occurrence in Australia, I have already referred. In spite of this, it is doubtful whether any museum in the world possesses a collection of even a few hundred specimens of these parasites, such as would adequately illustrate the various subfamilies, genera, and species.

With regard to the species parasitic in bees such as *Andrena,* in order to obtain the male parasites freely, I have found it necessary to note one fact in countries, which have a cool winter. It is known that sometimes in the case of *Andrena,* and probably generally, the male *Stylops,* like the bee it infests, is fully developed, even in midwinter, and only awaits the emergence of its host in the spring to issue from its body. Therefore the first appearance of the bees in the spring should be watched for, and their first appearance in the morning, since the *Stylops* will often emerge at the very moment that the bee first comes from its burrow into the sunlight. Later on the majority of the bees bear only female parasites, or the empty puparia of males. Notable exceptions are indeed known to these facts but nevertheless they are generally true of the genus Stylops itself, when parasitic on the spring species of *Andrena* in colder countries, and it is these species that are chiefly affected. On the other hand, fossorial Hymenoptera and wasps may retain the male puparia of *Xenos* and its allies unhatched for days and even weeks after capture, and in the case of the Fossores it is sometimes difficult to keep the hosts alive till the parasites emerge. With the parasites of Jassid leaf-hoppers, emergence from the puparia sometimes does not take place for a week or more after capture, but these leaf-hoppers are more easily kept alive in captivity than most of the Fossorial Hymenoptera.

EFFECT OF ATTACK OF STYLOPIDAE ON THEIR HOSTS.

The external and internal effects of stylopization on the hosts have been studied by various hymenopterists in the case of the typical genus *Stylops,* but they still require much closer further examination. In 1891 I showed that males of certain species of bees bearing the females of *Stylops* were apparently perfectly capable of reproduction. I have fully verified these observations subsequently. Piffard has recorded the fact of a stylopized male bee copulating, and I have myself since noticed similar cases, but in this respect the most remarkable case observed by me was that of the male of a leaf-hopper, a large species of *Tettigonia* bearing two great male puparia and two mature female parasites, which was in copula with a female carrying three or four parasites. Female bees of the genus *Halictus* infested with *Stylops* hibernate like healthy individuals. On the other hand, Theobald examining other species of *Andrena* came to a conclusion almost opposite to my own, which may have been due to the fact that the species investigated by us were different. I suspect however that it was largely due to two causes: (1) that he chiefly examined bees containing, or that had contained, male *Stylops,* the effect of which is much more severe on the host than is the female parasite; (2) he examined material in alcohol, and it is quite possible that, in the process of pickling, the contents of the *vesiculae seminales* were lost, as I have shown this may happen on contact with water, or possibly by the pressure of other parts on contraction in the alcohol. All my specimens were freshly caught ones, dissected under anaesthetics, and only after the whole genital system had been removed entire, glands, ducts and armature, were the bees placed in alcohol for the examination of other organs. It is obviously perfectly impossible that, in the species to which my paper refers, the germ cells were destroyed in the larva of the bee as Theobald says we should expect to be the case.

In the case of stylopized leaf-hoppers, I should judge that the effects are a good deal the same as in stylopized bees, from such observations as we were able to make on the former. (1) The male parasite injures the host more than the female, causing generally a considerable and often large distortion of the body .(2) Both male and female hoppers will copulate though very badly parasitized. (3) Death usually follows after the emergence of a male Stylopid, sometimes immediately, sometimes in a few hours, but sometimes not for some days in the case of especially robust hoppers, as also is the case with some wasps. (4) The much more fatal effect of the male parasite is not altogether due to the fact that the puparium is much larger (as to its protruded portion) than the mature female, and also usually more chitinized on its hidden segments, but it is largely due to the fact that, when the mature Stylopid emerges, the cap of the puparium being burst open and often altogether removed, a great opening extending far into the interior of the body of the host freely admits both light and air to the *viscera,* and this clearly produces most injurious and often rapidly fatal results. Possibly too it may be that the male parsite, so far more highly developed than the female, requires for its perfection to draw more heavily for nutriment on its host. Again in the case of leaf-hoppers, at least at certain seasons, no sooner does the male parasite emerge, than a fungous disease at once starts its attack in the opening thus made, the results of which are absolutely deadly. Sometimes, but much more rarely, one will find the fungus has developed at the point of protrusion of the female parasite. This fungus disease seems to be a constant concomitant of Stylopid attack on leaf-hoppers, both in America, Australia and Fiji. I have dealt with this question of the effect of the parasite at some length, because strenuous efforts were made to introduce *Elenchus* into these islands (it is to be feared unsuccessfully so far) for economic reasons, and it would be essential in my opinion to bring both the parasites and the concomitant fungus above mentioned to secure the best results. As, in Fiji, *Elenchus* attacks a species of *Perkinsiella* closely allied to our sugar-cane leaf-hopper, it could probably be much more easily imported from those islands than elsewhere.

THE GENERA *HALICTOPHAGUS* AND *ELENCHUS*.

The genus *Halictophagus.*

The literature accessible to me that deals with this genus is deficient, and I do not know whether this parasitic insect has been actually bred from the bee genus *Halictus* or whether its assignment to these common bees is altogether based on conjecture, as it was when Westwood wrote his "Introduction." On examination of the Australian Stylopidae that infest Jassids, it is evident that these are so extremely close to *Halictophagus* as figured by Westwood that I have left one of these species in that genus and have made a new subgenus for the reception of another. I incline to believe that *Halictophagus,* which appears to be very little known, and hardly noticed since J. C. Dale captured the type of the genus in 1832, and again took it in the same county (Dorset) in England in 1840, is really a Jassid parasite, and could be easily bred in numbers by any one who would investigate some of the Jassids in that country, *Agallia, Tettigonia,* or some such common form, being likely to prove its hosts. I am further led to believe its connection with *Halictus* is entirely suppositions because Mr. C. W. Dale, the son of the above named entomologist, writing 60 years after the type was obtained, says "*Halictophagus* is supposed to be a parasite of *Halictus, Elenchus* of *Prosopis.*" We know the latter assignment of host and parasite to be incorrect, and probably the former is also. The Australian species of *Halictophagus* and of which males are known are confined to Jassids, but females of a quite distinct species found on large Fulgorids are in my opinion also allied, and belong to the same group.

The genus *Elenchus.*

So far as our observations have gone, these being confined to a single species, *Elenchus* attacks only Delphacid leafhoppers, and of these only such as feed on Graminaceous plants, not those found on shrubs or trees. I see no reason, after the examination of dry and alcoholic material and specimens preserved in balsam, to specifically separate the Australian examples from the American (the latter from Ohio and California) nor either of these from the Vitian. Again I refer all these to the British *Elenchus tenuicornis.* Other species of *Elenchus* have been described from Mauritius and Britain, but whether these are all distinct, I feel some doubts. Dried specimens of these insects become more or less distorted or shrivelled, so that examples of one species though taken together often exhibit apparent differences from these causes. Mounted in balsam, slight differences in position often give a very different appearance to various structures, e. g., the antennae, genitalia, etc. Next to fresh specimens those preserved in alcohol are most suitable for study. Throughout Koebele's notes this species is referred to under the name *Colacina* Westw. on the authority of Mr. E. A. Schwartz but I cannot think that *Colacina* and *Elenchus* are identical. At any rate this is true *Elenchus,* and it does not seem likely that Westwood would have so forgotten this genus, which he knew well in 1840, as to make a new one for the same insect years afterwards. Mr. Koebele found in Ohio, at the same time as *Elenchus,* that a Jassid (*Agallia*) was also affected by a Stylopid parasite. On a slide are some mutilated specimens in balsam of the male parasites, which he found stuck to the glass in the tubes in which these *Agallia* were kept alive. I cannot see any difference whatever between these males and the *Elenchus* bred from Liburnia, but on examination of the dead *Agallia,* I find female Stylopids of a character so utterly different from that of *Elenchus,* that I imagine a *Liburnia* must have been accidentally included, from which the males in question emerged. Moreover the larvae from these females are different from those of *Elenchus.* I think it probable that the male of these females will prove to be a *Halictophagus,* but Mr. Koebele's well known accuracy and his opinion that the males sent came from *Agallia,* make further investigation necessary. By this I mean it is necessary to investigate *Agallia,* to prove whether it is at any time attacked by *Elenchus.* That these female Stylopids found in *Agallia* do not belong to that genus needs no investigation, and there is no possibility of their belonging to the males supposed to have been bred from the same leaf-hoppers; indeed there is no reason to doubt that they belong to the Halictophaginae.

THE LARVAE OF STYLOPIDAE.

The larvae of Stylopidae when they emerge from the brood-chamber of the female are often called triungulins, but very inappropriately so, since they entirely lack the very structures for which the name triungulin has been applied to the first instar of larval *Meloe* and other beetles. The larvae of Styloipds parasitic on Homoptera are much smaller and more difficult to study than are some of the wasp-parasites, and I have therefore figured in ventral view a larva of one of the latter (which is allied to Xenos) for comparison. This larva (Pl. IV, 5) when highly magnified is like *Lepisma* in general appearance and otherwise is chiefly remarkable for the great pigmented eye-spots around the lenses, and the structure of the elongate legs. The first two pairs of these terminate in the rounded pad noticed by writers on larval Stylops, but the hinder pair bear in place of this a long fine spine or seta, from which, near the extremity, there arises a finer and strongly curved one.

The young larva of *Elenchus* (Pl. IV, 3 and 4) in general resembles this, the legs being long, the eye spots large, and the pair of apical abdominal setae very long. All the legs however terminate in a long curved spine or seta, the two anterior pairs not differing much from the posterior. The ventral surface is much depressed, the dorsal convex. Each abdominal segment has a minute seta at the side, and on either side close to the middle line is an additional row of setae.

In the Australian subgenus *Bruesia* the larva (Pl. IV, 1 and 2) is larger than that of *Elenchus,* generally more parallel-sided, but both it and *Elenchus* are subject to considerable variation in shape according to the retraction or otherwise of the body segmnets. It also appears to differ from *Elenchus* in the arrangement of the setae of the ventral surface, but the claws of the legs are of a somewhat similar character, and unlike those of Xenos and the other hymenopterous parasites.

Newport's figure of the larva of *Stylops* reproduced in The Cambridge Natural History, if it be correct, would show that genus to be utterly unlike any of those here considered, no trace of the great eye spots being shown and the many jointed feet are utterly foreign to the species I have examined. Indeed I should not have recognized it as a Stylopid larva at all after my recent study of these.

THE PUPARIA OF STYLOPIDAE.

The puparium of a male Stylopid, that is to say the exserted portion, generally bears a great resemblance to the adult female except for the fact that it is rounded instead of flattened. In many cases the tubercles or depressions with which the apex is furnished closely resemble those in the female. As the male Stylopid becomes mature its head can be seen within the exserted apex of the somewhat transparent puparium, and this fact, combined with the great similarity between this part of the puparium and the exserted end of the female, would have satisfied me that in the latter it was the head end exserted, and not the tail as Meinert supposed, even if it had not been conclusively settled by the position of the ganglia in *Xenos.* Saunders has figured the adult *Elenchus* escaping from the puparium ventral side upwards—we have frequently watched the same insect issuing in this manner—and remarks that *Xenos* does the same, but that *Stylops* and *Hylecthrus* are said to emerge in reversed position. The puparia of all the Stylopids examined by us, on the emergence of the mature insect, split open by the regular dehiscence of an apical cap. The pupa itself, as it approaches maturity, is more or less visible through the shell. It appears to me of a decidedly Coleopterous type, and when the mature insect emerges the pupal skin is shed as the most delicate of pellicles.

SOME RELATIONS OF PARASITE AND HOST.

In the case of *Xenos* parasitic on wasps of the genus *Polistes*, Hubbard noted the marked hostility of the host towards the parasite. Brues did not observe this with his specimens, and suggests that this was due to the fact that no females of the *Xenos* were present in the wasps that he studied, and consequently that the males of the parasite did not approach these for the purpose of pairing. This is very probably the true explanation of the difference in the wasps' behaviour in the two cases, in confirmation of which one may cite the old and often quoted observation of J. C. Dale: "Putting two bees (*Andrena labialis*) under a glass in the sun two Stylops were produced: the bees seemed uneasy and went up towards them, but evidently with caution, as if to fight; and moving their antennae towards them, retreated. I once thought the bee attempted to seize it; but the oddest thing was to see the Stylops get on the body of the bee and ride about, the latter using every effort to throw his rider." This certainly seems to point to the conclusion arrived at by Brues, the *Andrena* in question probably bearing a female specimen of the parasite. In the case of leaf-hoppers, we did not notice any sign of disturbance on the part of the host at the presence of the male parasites, nor did we ever see copulation take place, though we often had many male and female *Elenchus* in the same jar. It will probably prove that the remarkable mandibles of many male Stylopids are for the purpose of holding on to the host during the pairing of the sexes. In general it would appear that these organs are less remarkable in the parasites that attack leaf-hoppers, than in those that occur in bees and wasps, in fact in some of the former class they are small and of very simple form.

In the case of *Polistes* there is, according to Brues, a well-marked tendency for all the parasites in one wasp to develop the same sex. This is also notably the case with some of the Stylopids affecting the Fossorial Hymenoptera, but with those attacking leaf-hoppers it is often quite otherwise, and it is of the commonest occurrence to find male and female parasites in the same individual hopper.

It is perhaps worthy of notice that the male puparia of the species of *Halictophagus* parasitic on Jassids, pierce the dorsum or even the venter of the abdomen of these leaf-hoppers, but the head of the female is always, or nearly always, thrust through the pleura. On the contrary in *Elenchus* and *Deinelenchus,* parasitic on Fulgorids, the male puparium (as well as the head of the female parasite) is exserted from the pleural region only.

In the case of the *Halictophaginae* we found only mature leaf-hoppers to contain mature female parasites and puparia; but in the case of *Elenchus tenuicornis* the nymph or adult Delphacids will alike produce mature parasites of either sex.

CLASSIFICATION.

The differences between the various forms here considered are so great, that if the Stylopidae are considered as a family of Coleoptera, they must represent three sub-families; or if these parasites be treated as a separate Order, Strepsiptera, they might even form three families. The marked differences in the head, legs, and thoracic sclerites being probably sufficient to warrant the higher division. They may be distinguished as follows:

1. Tarsi 4-jointed	Stylopinae.
2. Tarsi 3-jointed	Halictophaginae
3. Tarsi 2-jointed	Elenchinae

As personally I consider the Stylopidae to be a Coleopterous family, the divisions here are treated as sub-families.

The first of these divisions is capable of further subdivision, of a character in my opinion more than merely generic, but it is not necessary to enter into these minor distinctions here. The family will, naturally, be placed next to the Mordellidae (incl. Rhipiphoridae).

The measurements and descriptions of the female Stylopidae are made from the head, as it appears when the animal is imbedded in its host; for the variation in the length of the exserted portion in different individuals is very small.

Female Elenchinae are (so far as the species collected by us are concerned) easily distinguished from Halictophaginae by the absence of the median apical plate and other apical structures, and the presence of discal areas in front of the brood-chamber opening.

LIST OF SPECIES OF STYLOPIDAE HERE CONSIDERED.

STYLOPINAE.
  Gen.? sp. nov. near Xenos.

HALICTOPHAGINAE.
  Halictophagus.
  H. schwarzii,, sp. nov.
  H. americanus, sp. nov.
    subg. Bruesia, subg. nov.
  B. australensis, sp. nov.
  B. phacodes, sp. nov.
  B. stenodes, sp. nov.
  Megalechthrus, gen. nov.
  M. tryoni, sp. nov.

ELENCHINAE.
  Elenchus.
  E. tenuicornis, Curt.
  Deinelenchus, gen. nov.
  D. australensis, sp. nov.

GENERAL STRUCTURE OF STYLOPIDAE.

As the position of Stylopidae as a whole amongst the Insecta has been a cause of much discussion and disagreement, so the character of various structures has also been diversely interpreted. There is no question that the mouth-parts are of an abnormal character, and difficult to study, but that there should have been differences of opinion as to the thoracic sclerites and their appendages is not so easily understood. Even in the minute *Elenchus*, by far the most difficult of the Stylopidae to dissect, the prothorax and mesothorax can easily be separated entire, each in the form of a complete ring, exhibiting notal, pleural, and sternal portions, well marked, the former sclerite bearing the front legs, the meso-thoracic, in addition to the middle pair of legs, having the ladle-shaped elytra attached to the sides.

The mouth parts of *Elenchus* and its other characters have been elaborately discussed by Eaton, but the figure given by him is an unfortunate one, owing to the position in which it was drawn; for of the part which he considers the *ligula*, the extremity approximate to the labium is not visible at all. Nevertheless, had I examined no other Stylopid than *Elenchus*, I might possibly have agreed with his interpretation of the mouth parts, but the examination of a species of a genus allied to *Xenos*, and more especially a close study of the head of a species of the subgenus *Bruesia* (hereafter described) and of a species of *Halictophagus*, leads me to favor a different interpretation. The delicate transverse band on the under side of the head I agree in considering labium, the two-jointed organ on either side of it being probably the labial palpi. The part called ligula by Eaton requires close study being in many Stylopidae bent at an angle, to form two planes; when the upper part is seen in full surface view, the lower part meeting it at a strong angle slopes very strongly backwards from the point of meeting. This structure might be called an epistome, but it is possible that the lower part is really the labrum or upper lip, the position of which it occupies. Between the apex of the lip and the labium approximated to it, is the closed, or obsolescent oral aperture. The so-called mandibles are probably rightly so called. Adopting Eaton's interpretation the oral aperture of *Elenchus* is bounded by and in fact leads into the frontal process, but this seems to me certainly erroneous. According to the view here suggested by me, the mouth parts of the Stylopidae are not so extremely remarkable. The difficulty of studying the insect is not only due to the small size and delicate structure, but also to the fact that the sides of the face within the eyes have sharp protuberant edges, so that this part is more or less deeply excavated, the other structures being partly or wholly immersed, and further obscured by the mandibles and palpi. In *Bruesia australensis* however, and *Halictophagus schwarzii*, the face is much more open, and after dissecting off the mandibles and palpi the parts can be studied with comparative ease. It was therefore found advisable to carefully examine these before coming to any decision as to the mouth-parts of *Elenchus*. In Pl. I, fig. 1, is a diagrammatic view of the front of the head, simplified from what is actually seen in *Bruesia* and *Halictophagus*, as I interpret it, actual figures of these being given on the same plate, fig. 2 and 5. The parts indicated by the letters b and d together represent what I have already called epistome, of which however, the lower portion (d) may be labral; e is the labium, and the closed, or at least obsolescent, oral opening is the slit between d and e. For the rest, the other parts are sufficiently explained in the description of the figures, but special attention must be called to the foramen (c) at or near the junction of b and d. This exists in *Elenchus*, *Halic-*

tophagus, Bruesia and in the species examined of a genus allied to *Xenos*, in fact in all the male Stylopids considered in this paper, and as it furnishes an easy means of identifying homologous parts of the face, it is of great importance.

If we now consider the parts of the face in *Elenchus* as compared with *Bruesia* the most striking difference noticed at once is the fact that the part immediately above the *foramen* (which corresponds to b in the diagrammatic figure) appears to end above in a free edge and not to be sutured to the frontal process. It is this edge that Eaton considers the apex of the *ligula,* and the cavity between it and the frontal process as the oral opening. I believe however that this edge is not the real extremity of this plate but is due only to a sharp bend therein. We are therefore left with two alternatives: if we consider with Eaton that there is a great *ligula,* then in *Bruesia* and *Halictophagus schwarzii* the apex of the ligula is not free, but continuous with the frontal process, and not even divided therefrom by a distinct suture; or if we adopt the interpretation that I favor, we shall consider the same part as epistome, or epistome and labrum, though in some genera its basal (upper) margin is deeply imbedded in the excavated front of the head. A strong immersion of the clypeus beneath the level of the front, or of labrum beneath the clypeus, is by no means unfamiliar in other orders of mandibulate insects. In a species of a genus allied to *Xenos,* the head of which is figured on Plate I, fig. 4, it will be seen that the epistomal portion lies entirely immersed beneath the prominent edges of the sides of the face. As to the division of the lower part of the face into epistome and labrum, both in a dry specimen of *Bruesia* and in one mounted in balsam, I think I can detect faint sutures, marking off a labrum from the epistome, and I suspect that the foramen always marks the division between these.

THE THORACIC SEGMENTS.

The pro- and meso-thorax appear to be always small and ringlike, and one or both of these are immersed in the posterior concavity of the head (Pl. I, fig. 3), and on superficial examination may even appear to be part of this.

In some figures of Stylopidae the top of the head is represented as much more solid than it really is, the pronotum probably having been considered as part of the vertex. The metathorax differs greatly in the arrangements of its parts in different genera. In *Elenchus* (Pl. II, fig. 11) the posterior of the four anterior lobes, which may be called the scutellum, is semilunar, and extremely small compared with the great triangular anterior lobe, not penetrating forwards between the lateral lobes. The post-scutellum also is unusually short.

In *Halictophagus* and *Bruesia,* (Pl. II, fig. 9) the scutellum is triangular, but much smaller than the anterior lobe, penetrating somewhat between the lateral lobes, the post-scutellum being very elongate. In a genus allied to *Xenos* there is a great triangular scutellum, produced far forwards between the lateral lobes and longer than the anterior lobe (Pl. II, fig. 10). It is clear that the structure of the thorax will prove of great use in the classification of Stylopidae. The great differences between the tarsi of the several subfamilies are shown in Pl. II, figs. 6, 7 and 8, and also the wings of *Elenchus, Bruesia* and ? *Halictophagus* on the same plate (figs. 1, 2, 3), so that it is not necessary to refer further to these.

DESCRIPTIONS OF GENERA AND SPECIES.

Bruesia n. subg. (of *Halictophagus*).

Head very deeply concave behind, seen from above consisting only of a narrow rim supporting the eyes, and produced considerably in front of these to form the tip of the blunt and wide frontal projection, at the sides of which the antennae are inserted. That which appears to be the top of the head on superficial inspection, is in reality the dorsum of the pro- and mesothorax, which in their natural position are deeply immersed within the posterior concavity of the head, which they more or less fill up. Antennae with the two basal joints simple, the following excessively short, being produced laterally into an elongate and thin lamina, the first and fifth (or last) of these laminae being larger than the others and capable of enclosing them in a fan-like fashion. Mandibles very short compared with those of other Stylopids, their tips not reaching one another, simply pointed. Labial palpi very large, the second joint foliaceous half as wide as long, pilose, subacuminate at the apex. Scutellar portion of metanotum moderately large, penetrating somewhat between the lateral lobes of its anterior portion, triangular, and very different from the small semilunar scutellum of *Elenchus*; the post scutellum very elongate, twice as long as wide, or appearing still longer in dry specimens, covering several of the basal abdominal segments. Elytra clavate or ladle-shaped in well-preserved specimens. Wings smoky hyaline, neuration black, very distinct. Tibiae dilated apically, and grooved or hollowed above for the partial reception of the three-jointed tarsi, when these are drawn up.

1. *Halictophagus* (*Bruesia*) *australensis*, sp. nov.

Black or blackish fuscous, the thorax paler, piceous or brownish, the lamellate joints of the antennae also paler, yellowish or sordid testaceous. Wings smoky hyaline, with slight but evident iridescence, the neuration strong, black. Apical abdominal segment with its genital process concave above and much produced, towards the base with an upright tongue-shaped, pilose organ; in lateral view the sides are slightly convergent to the apex, which is armed with a recurved hook, the tip of which is itself bent upwards; in front of the origin of this uncus the process has a small deep emargination. The apical ventral segment is triangular and produced at the apex. The abdomen is clothed with a very delicate cinereous pubescence. Expanse about 4 mm.

Female. Head yellow or brownish yellow, distinctly rounded at the sides, with a distinct anterior median area (or plate) marked out, and slightly produced; tuberculate on either side of this area in front. The opening of the brood-chamber is behind the middle of the exposed part of the head, the surface between this opening and the apex subconvex. Length about ⅓ mm.

(Plate I, figs. 3, 5 and 9; Plate II, figs. 1, 7, 9 and 12; Pl. III, fig. 8 and 9.)

Hab. Cairns, Queensland, parasitic on a very common and conspicuous species of *Tettigonia,* many parasitized examples being taken by us. (No. 2238).

2. *Halictophagus* (*Bruesia*) *phaeodes,* sp. nov.

Female. Head broader than long, brown, more yellowish in front and darker behind the opening of the brood chamber, strongly rounded at the sides, the anterior median area defined and slightly produced, tuberculate on either side of this area in front; the surface slightly convex between the opening of the brood-chamber and the apex. Length about ¼ mm.

(Plate III, fig. 3).

Hab. Cairns, Queensland; one female specimen parasitic on a common green flat-headed Jassine of the genus *Hecalus.*

3. *Halictophagus* (*Bruesia*) *stenodes*, sp. nov.

Female. Head narrow, subelongate, sides not strongly rounded, more parallel-sided, piceous, shining, opening of the brood-chamber near the middle of the head, the surface slightly convex. Otherwise agreeing generally with the preceding. Length about $\frac{1}{4}$ mm.

(Plate III, fig. 2).

Hab. Cairns, Queensland. One female, parasitic on a small seed-like brown Jassine of the genus *Paradorydium*. I also took one bearing a male *puparium*.

? *Halictophagus* Curtis.

The species, which I provisionally assign to this genus, differs from the male of the subgenus *Bruesia* in that the five apical antennal joints are not all of thin laminate form throughout, but the basal ones of these are of more normal form, and the branches are less thinly laminate. The face, as far as I have been able to examine it, appears to be of simple form, the middle part not much separated from the lateral elements, nor deeply immersed beneath the latter, and the palpi to be much more slender than in *Bruesia*. The general form of the metathorax, tarsi, and genital segment is the same as in that subgenus.

The unique specimen described was originally mounted on a slide in balsam and much distorted, the prothorax and front legs being so displaced as to overlie and conceal the head, while one crumpled wing concealed the body. It was therefore removed from the balsam, cleaned, and relaxed, so far as was possible; the one wing was removed and the prothorax was put more or less into its proper place.

It is most probable htat this insect is not true *Halictophagus*, but possibly it may be included in *Bruesia*, when the latter ranks, as I have little doubt it will, as a good genus. In Westwood's figure of *Halictophagus*, the metathorax is very different, as also is the terminal abdominal segment, in which the Australian forms closely resemble one another. In the antennae however the present species is intermediate between *Halictophagus* and *Bruesia*. (See Westwood Int. Mod. Class. Ins. II, fig. 94, 10 and 14).

4. *Halictophagus? schwarzii*, sp. nov.

Black, clothed with extremely delicate sericeous pubescence, which is cinereous in some parts; the extreme tip of the abdomen testaceous; metathorax more or less obscurely pale in some parts, at least along some of the sutures. Antennae blackish, third and fourth joint short, subtriangular, with one of the apical angles produced into a long branch, fifth and sixth joints shorter than the preceding, more ring-like, but produced into similar branches; seventh joint lamellate throughout. Wings subhyaline, slightly smoky and iridescent, the nervures very distinct, blackish. Expanse 3 mm.

(Plate I, fig. 2 and 7; Pl. II, fig. 2).

Hab. Mittagong, New South Wales, bred from a common Bythoscopine Jassid, *Agallia* or an allied genus, found on Melaleuca (Koebele 2356). I have named this after Mr. E. A. Schwartz, who was interested in the Stylopids discovered in Ohio by Mr. Koebele, and has often placed his knowledge at Mr. Koebele's service.

5. *Halictophagus* (?) *americanus*, sp. nov.

Female. Dark brown or piceous, suboblong, the anterior median area distinct in apical view, but generally hardly visible in surface view, owing to its position on the apex of the head, which is bent at an angle to the outer surface; tuberculate on either side of this area; the whole disc of the head deeply impressed so as to form a great cavity leading into the opening of the brood-chamber. Length about $\frac{1}{6}$ mm.

It is, I should think, almost impossible that this female can be congeneric with those I have assigned to the subgenus *Bruesia*. It would not be surprising to find that this is really the female of *Halictophagus* proper, though we have no proof that such is the case. As the parasite is so common in Ohio on the Jassid *Agallia* 4-*notata* it is to be hoped that the entomologists of that state will quickly decide his question.

(Plate III, fig. 6).

Hab. Columbus, Ohio; taken abundantly by Mr. Koebele, (No. 2191).

Megalechthrus, gen nov.

Female. Head ovate, moderately elongate, the opening of the brood-chamber near the middle or rather in front of it, the small anterior median area distinct, a little produced in front, and tuberculate on either side of this area in front. This large form appears to be allied to *Bruesia* and *Halictophagus*, but is

I think distinct generically from these, by its long, ovate form and great size.

Megalechthrus tryoni, sp. nov.

Female. Head ovate, moderately elongate, yellow or brownish yellow, shining when clean, but often dull from the excretion of its host, more strongly convex behind the orifice of the brood-chamber than in front of it.

Male puparium brown or pitchy, unicolorous or nearly so. Length about ⅔ mm.

(Plate III, fig. 5.)

Hab. Cairns and I think noticed in other localities in Queensland. Unfortunately we did not breed the male, not having time to pay any particular attention to this parasite, though we frequently noticed Fulgorids of the genus *Platybrachys,* or its allies, to be affected by it. I have named the species after Mr. Henry Tryon the Government Entomologist of Queensland, whose wide general knowledge of the fauna of that State is so well-known to all.

Elenchus, Curt.

The characters of this genus have been elaborately drawn up by Eaton and it is not necessary to repeat these. I have already stated wherein I differ from him in the interpretation of the mouth parts. Briefly what he considers to be the ligula I consider to be epistome or epistome and labrum, the oral aperture of his description being merely a deep concavity beneath the frontal projection. Although what he considers to be the third and fourth antennal joints are unquestionably morphologically so, yet it appears that at the point of their divergence these may be connected by a thin submembranous portion and not perfectly free. Further he remarks that the wings are "well represented by previous authors," but Westwood's figure of these is quite unlike any specimen I have seen, in neuration, and the same remark applies to the metathoracic acutellum.

Elenchus tenuicornis, Kirb.

Female. Head brownish or pitchy, opening of the brood-chamber far behind the middle and very large, no anterior median area and tubercles defined, but with a faint round spot just in front of the brood-chamber orifice on each side of the middle line. Length $\frac{1}{6}$ mm.

Male. Apparent slenderness of the antennal joints varying much according to aspect and from shrinkage. Metathorax paler in some than other; in balsam specimens becoming much paler with age.

(Pl. I, fig. 6 and 8; Pl. II, fig. 3, 4, 5, 6, 11 and 12; Pl. III, fig. 4.)

Hab. Columbus, Ohio, and Alameda, California, or *Liburnia lutulenta* in abundance (Koebele). Everywhere abundant in Queensland on *Liburnia* and other Delphacids, and also in Fiji.

Deinelenchus, gen. nov.

Female. Head nearly circular, very wide, the anterior margin simply and widely rounded, with no defined anterior median area, and without evident tubercles in front. Between the opening of the brood-chamber and the anterior margin there are two distinct areas marked out by impressed lines, which run backwards to the brood-chamber orifice as deep grooves on either side of a smooth slightly raised tubercle. Opening of the brood-chamber bisecting the head in surface view.

This insect is much larger than *Elenchus* and seems to me evidently allied to that genus, by the absence of a definite anterior median area and the presence of those on the disc, between the anterior margin of the head and the orifice of the brood-chamber. Still it can hardly be generically identical.

Deinelenchus australensis, sp. nov.

*Female. Head brownish in front of and yellow behind the brood-chamber orifice. The discal areas between the latter and the apical margin somewhat fan-shaped, and themselves divided by very fine grooves. Sometimes in apical view of the head two round faint spots can be seen, but there is no definite median area, nor tubercles. Length and breadth each about ⅔ mm.

Male puparium dark brown with a pale ring at the base of its protruded portion.

(Pl. II, fig. 7.)

Hab. Cairns and Brisbane, Queensland; on a Fulgorid (*Platybrachys* or allied genus). Koebele's No. 2254.

OBS. At various places during the six months that Mr. Koebele and myself were together in Australia, we found isolated individuals of leaf-hoppers, containing male puparia of Stylopids, which had already hatched, or from which we bred no imago. These would comprise some four or five species of Jassids not mentioned in the foregoing account, the commn *Tettigonia albida, a Deltocephalus? a Phlepsius?* and one or more *Bythoscopines* being among these. No doubt the parasites attached to some of these will prove to be different from those here described, and yet many other new ones remain to be discovered.

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* For characters of male see supplementary note, p. 108.

SUPPLEMENTARY NOTE.

After completing the above account of the Stylopidae and sending it to press, it occurred to me that by sacrificing the few male puparia that we preserved, mature pupae of the two genera *Megalechthrus* and *Deinelenchus* (which are characterized on females) might be obtained in such condition as to allow some male characters to be determined. These puparia were therefore opened and the contents examined; most of them were empty, the male Stylopids having emerged, but in two cases I obtained very immature and dried up pupae of ***Megalechthrus***. No details of structure could be made out sufficiently accurately from these, but I believe the rudiments of the antennae contained 7 joints, five being foliaceous, and this would confirm its position in the Halictophaginae.

From puparia of *Deinelenchus* I obtained no pupae, but in one was a mature dry male of *D. australensis*, amply confirming its position in the Elenchinae and the validity of the genus. I here add the generic characters of the male, and a specific description.

Deinelenchus (male char.)

Like *Elenchus* in most respects e. g. in the structure of the tarsi and antennae, but very much larger, and with the second antennal joint, seen from above, very short and transverse, the basal one elongate. Frontal process much blunter and less prominent than in *Elenchus*. As in that genus, the face is deeply excavated, but it is much more open, not triangular, but with the sharp edge of the front and sides forming a great semicircle, or rather more. The palpi are two-jointed sparsely pilose, the second joint narrower than the first and in the form of a curved blade. The large size and wide excavation of the face of this genus renders it much easier to examine structurally than *Elenchus*, and the structure seems to me to greatly favor the interpretation of the mouth-parts, that I have adopted. The edge, which, in *Elenchus*, Eaton supposed to be the apex of the ligula, is in *Deinelenchus* easily seen to be no free edge at all, but is due to a bend perhaps augmented by a ridge in the part I have called epistome. The post-scutellum of the metathorax is longer than in *Elenchus.*

D. australensis.

Male. Piceous, perhaps blacker in mature specimens; the sides and scutellum of the metathorax pale, its anterior lobe and postscutellum dark. Legs with the femora pale, the tibiae dark, fuscous. Elytra for the most part blackish, the wings (not spread) apparently quite smoky, with a slight iridescence, the neuration black. Expanse probably about 4.5-5 mm.

Hab. Cairns, Queensland; extracted from a puparium in the abdomen of a female of a large Fulgorid of, or allied to, the genus *Platybrachys.*

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An extensive bibliographic list is given by Brues and as his paper is cited below, it is not necessary to refer to the titles that are therein listed. I merely refer to one or two, which he has passed over.

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DESCRIPTION OF PLATES.

I.

Fig. 1. Diagrammatic figure of head of Stylopid; a frontal process, b and d epistome or epistome and labrum, c foramen, e labium, f palpus, g mandible, h sides of face along inner orbits, i eye, j antenna.
" 2. Head of *Halictophagus schwarzii* front view.
" 3. Dorsal view of head and front part of thorax of *Bruesia australensis;* a pronotum, b. mesonotum.
" 4. Head of sp. nov., gen. ?, near Xenos; front view.
" 5. Head of *Bruesia australensis,* front view.
" 6. The same of *Elenchus tenuicornis.*
" 7. Antenna of *Halictophagus schwarzii.*
" 8. The same of *Elenchus tenuicornis.*
" 9. The same of *Bruesia australensis.*

II.

" 1. Wing of *Bruesia.*
" 2. The same of *Halictophagus schwarzii.*
" 3. The same of *Elenchus.*
" 4. Elytron of *Elenchus,* lateral view.
" 5. The same from above.
" 6. Tarsus of *Elenchus.*
" 7. The same of *Bruesia.*
" 8. The same of genus near *Xenos.*
" 9. Metanotun of *Bruesia.*
" 10. The same of genus near *Xenos.*
" 11. The same of *Elenchus.*
" 12. Terminal segment of *Bruesia.*
" 13. The same of *Elenchus.*

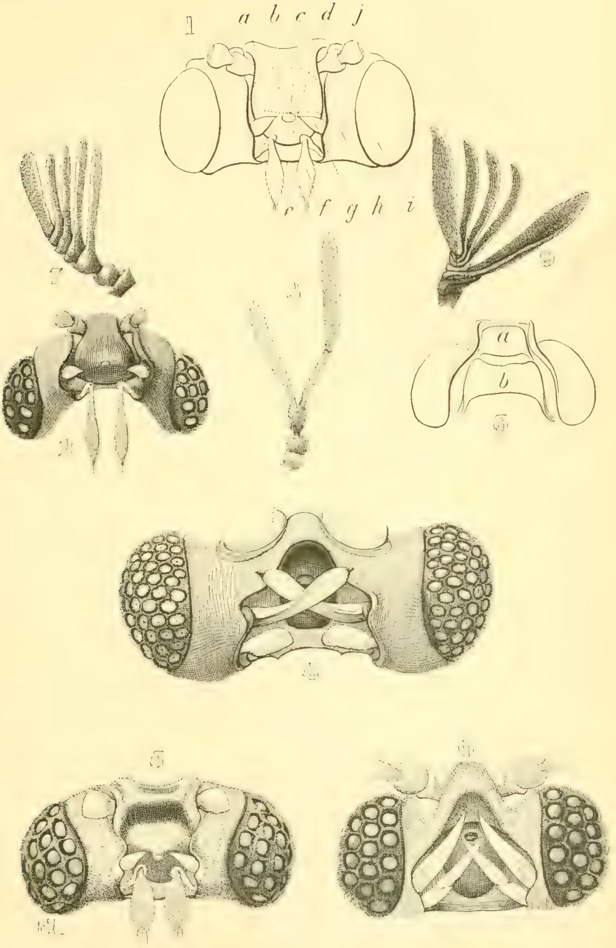
III.

" 1. Ventral view of abdomen of a Fulgorid (*Platybrachys* or allied genus) showing female parasites and male puparia.
" 2. Head of female of *Bruesia stenodes.*
" 3. The same of *Bruesia phaeodes.*
" 4. The same of *Elenchus tenuicornis.*
" 5. The same of *Megalechthrus tryoni.*
" 6. The same of *Halictophagus? americanus.*

" 7. The same of *Deinelenchus australensis.*
" 8. The same of *Bruesia australensis* removed and mounted in balsam.
" 9. The same not removed from the host.

IV.

" 1. Larva of *Bruesia australensis,* lateral view.
" 2. The same in dorsal aspect.
" 3. Larva of *Elenchus,* ventral view.
" 4. The same in dorsal aspect.
" 5. Ventral view of sp. nov. gen? allied to *Xenos.*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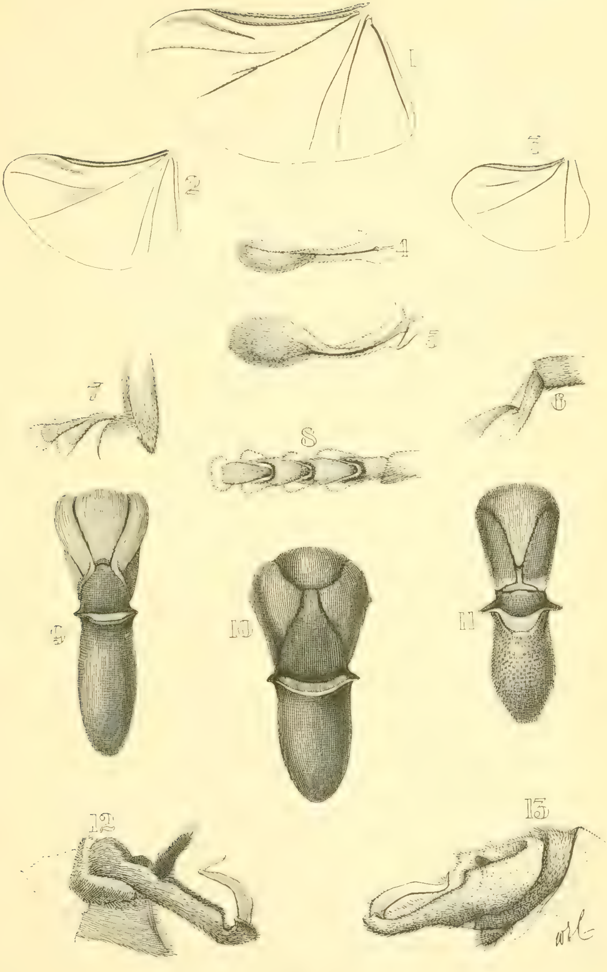
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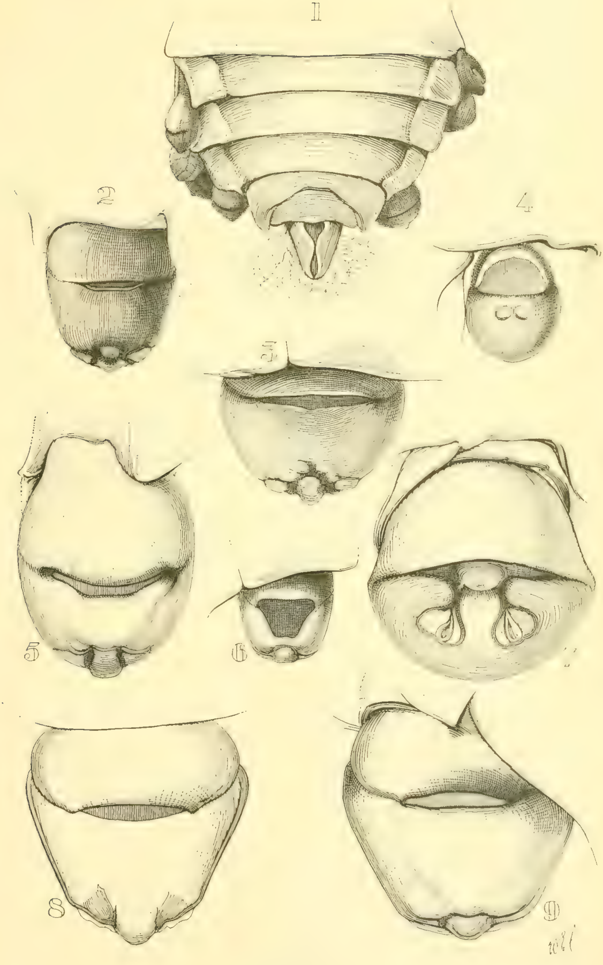

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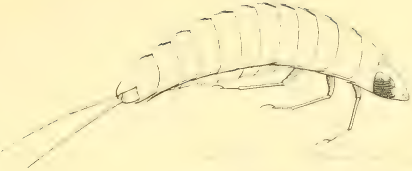

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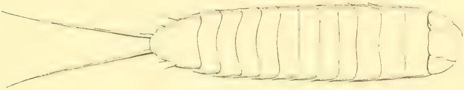

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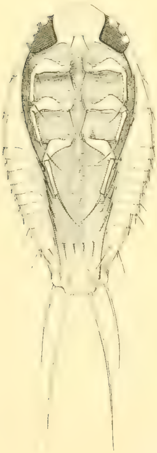

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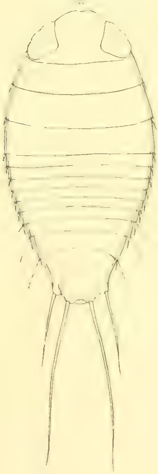

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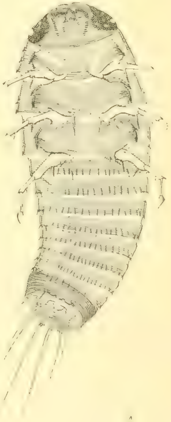

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PLATE IV.

DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 4

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(*PT. IV. PIPUNCULIDÆ*)

BY R. C. L. PERKINS

HONOLULU, H. T.
SEPTEMBER 9, 1905

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SEPTEMBER, 1905

LETTER OF TRANSMITTAL.

To Special Committee on Experiment Station, Hawaiian Sugar
Planters' Association, Honolulu, T. H.

Gentlemen:—I herewith submit for publication Part IV of Bulletin I. This deals with the two-winged flies parasitic on leaf-hoppers, thirty-four species of these parasites being here enumerated, and thirty-one of these described as new.

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

Honolulu, T. H., August 11th, 1905.

GENERAL REMARKS ON THE PIPUNCULIDAE.

The Pipunculidae are a very distinct family of small and obscure flies, which in their habits, so far as these are known, all agree in the fact that they are parasites of the Homopterous Rhynchota. There are but few genera in this family, the great majority of the species being referred to the genus *Pipunculus*, as are all the new species described in this paper.

Verrall in his "British Flies" (Syrphidae, etc.) published in 1901 gives the known species of *Pipunculus* as nearly 50 European, about 8 North American, 1 Brazilian, 8 South African, 6 Central American, and 2 Chinese. He also mentions New Guinea as a habitat. About the same time three new species were described by Grimshaw from the Hawaiian Islands, making a total of about 80 species for the genus. It is probable that at the most not more than one in ten existing species has been collected, for while the genus appears to be ubiquitous in distribution, its members are too unattractive in appearance and too fragile to have been much sought after in the tropics, and further I am quite satisfied that many of the species will not be easily obtained except by breeding them. The latter statement applies particularly to some species that attack arboreal leaf-hoppers.

As a matter of fact it appears that extremely few of the many known species have been bred, or at least of very few has the fact been recorded. Of the 26 species found by us in Australia, 15 were bred from the leaf-hoppers themselves, and one from collected pupae, the host being unknown to us.

Inconspicuous as the flies are when seen in a collection, even more so are they in life, for when on the wing most of them appear even smaller than they really are. Some of the Australian species under favorable circumstances occur in prodigious numbers. In the dry bed of a stream near Cairns at the end of August there were small patches of green grass at intervals, when the surrounding country was dried up. On these patches of grass large flocks of various small Jassid and Fulgorid leaf-hoppers were feeding, and, in search of the former, countless numbers of a species of *Pipunculus* (*P. beneficiens*) were passing from patch to patch in endless procession, threading their way amongst the grass stems. At any time an insect net could be thrown over half a dozen specimens at once, as they moved along. In similar abundance Mr. Koebele found the same species on some sandhills near Bundaberg, on an occasion when I was not with him. Many of the grass-loving species fly very low and irregularly amongst the grass, as if making a close scrutiny on all sides as they pass along.

On another occasion in a wood at Bundaberg, where a species of *Siphanta* was breeding in large numbers on *Ficus* and other trees, *P. helluo* was literally swarming, buzzing round every twig, even in the deep shade of the trees. The nymphs of this *Siphanta* are always concealed beneath the leaves, feeding on the under surface, and when making particular scrutiny of these, the fly would be seen to hover and poise itself like an ordinary Syrphid, giving up its usual, more erratic and irregular flight. The latter was quite similar to that of a hymenopterous parasite of the genus *Chalcis*, which, seeking caterpillars on the same trees at the same time, was as common as the fly; in fact these two very different parasites were not very easily distinguishable when on the wing. Owing to the position of the nymphs of the *Siphanta* I was not able to see the fly actually sting these, but several times one was observed to make a dart beneath a leaf, where the young leaf-hoppers congregated. By collecting some of these nymphs, the *Pipunculus* was easily bred in confinement. Dr. F. Jenkinson of Cambridge in 1903 published an account of the attack of *Verrallia*, a genus allied to *Pipunculus*, on frog-hoppers (Ent. Monthly Mag. XXXIX (1903) p. 222) and I herewith give in full this interesting note:

"I suppose the oviposition of *Pipunculidae* has been recorded somewhere, but I have not seen it described; although the form of the ovipositor and the strong legs and claws (sometimes at least larger in the female) enable us to guess what must take place. Noting *V. aucta* to be common in my garden on the morning of July 5th, I determined to watch them as they busily beat over every inch of the herbage. I sometimes had four in view at one time. Frog-hoppers being as scarce as *Verrallia* was common (perhaps these facts are not entirely unconnected with each other), I occasionally caught one and put it in the *Verrallia's* path, with complete success. As soon as a *Verrallia* saw a frog-hopper it poised itself in the air (like a kestrel hovering, but with a certain intensity perceptible in its motionlessness), and if the position of its victim was favourable, it pounced upon it immediately. Then the frog-hopper hopped; in some cases the fly lost it; in some cases the fly reappeared instantly from the place to which the frog-hopper hopped. In one case I saw the frog-hopper land with the fly still on its back ; I caught both, without waiting, as perhaps I should have done. If the position was unfavourable, or stems got in the way (e. g. *Geranium Robertianum*), the fly would circle round with its head towards the victim, like a male *Dolichopus*, seeking a point from which to pounce. On several occasions it failed to get a hold. Once a fly pounced on a frog-hopper *which did not hop*; the fly immediately left it. Another came up and looked at it, but went away without touching it. Was the frog-happer already entertaining an egg, or was it a male, or for some reason unsuitable? *Chalarus* is common in my garden, but I have not been able to see anything of its oviposition.

"These observations are crude and inconclusive on several points; but I send them on the chance that others who can afford the time will complete them. The flies are still common, and the frog-hoppers now less scarce."

Verrall remarks that he considers the Pipunculidae to be the most exquisite fliers that exist in Diptera. However true this may be of the European, I do not think it can be said of the Australian or Hawaiian species, which cannot compare in power and beauty of flight with many Syrphidae or other flies; indeed to cite but one instance they are vastly inferior to the Australian species of *Baccha* in this respect. It is certain however, that on capture they often exhibit to the full their power of hovering within the meshes of the net, where more sturdy species, which while free can remain poised and motionless in the air or dart forward with speed that baffles the vision, would under like circumstances beat wildly against the sides in their endeavour to escape.

The Pipunculidae are known to affect various families of Homoptera, the spittle-insects or Cercopidae, as well as the Jassidae and Fulgoridae, and perhaps the Cicadidae, being subject to their attacks. It is not known whether in any case the same species of parasite will attack leaf-hoppers of more than one family, e. g. Fulgoridae and Jassidae. In this connection, however, one may mention the fact that the resemblance between such species as *P. helluo* and *P. Koebelei* is extreme, both structurally and superficially, although the former is parasitic on *Siphanta* and the latter on a Jassid somewhat allied to *Penthimia.* The fact that the two flies are so extremely similar while the hosts are so utterly unlike leads me to suspect that species of Pipunculus may be found that attack species of either family of leaf-hoppers indiscriminately. However this may be, it is certain that some of these flies will attack very different species of leaf-hoppers within the limits of a family. For example that most common Australian species *P. beneficiens* was bred from nymphs of three or four very different Jassids, and *P. cruciator* from two widely different genera, of the same family. It may also be noted that nymphs and adult leaf-hoppers are both subject to attack.

In Australia all the species of *Pipunculus*, that we bred, were from Jassidae, excepting two, one of which (*P. helluo*) is a parasite, as above mentioned, on *Siphanta* and allied genera, while the other (*P. xanthocnemis*) attacks a species of *Liburnia*. The Hawaiian species here described are probably all attached to Delphacine Fulgorids. Three of the five most certainly are, since one of the latter has been bred by Mr. O. H. Swezey, and the other two are found in company with the same leaf-hoppers, in places where Jassids are quite absent.

There is, so far as I know, no means of telling with absolute certainly whether a living leaf-hopper contains a larva of *Pipunculus* or not. In some species of a green colour, when the parasitic larva becomes large, the green of the hopper is not infrequently changed to a sickly yellow, or even dark discoloration may be seen, but in most cases a slight sickly appearance, evidenced by indescribably minute differences in its superficial appearance, or by its more lethargic movements, alone inform one, or at least lead one to suspect, that the leaf-hopper is parasitized. Practically it is not difficult to detect parasitized individuals, when one is familiar with the species of leaf-hopper that is infested. If a green Jassid containing a large *Pipunculus* larva be placed in alcohol, so that the colouring matter is largely removed, and greater transparency is attained, it is sometimes possible to see the parasitic larva quite plainly through the cuticle of its host. The head of the larva appears to be always turned towards the head of the leaf-hopper, and generally the parasite fils up by far the greater part of the abdomen of its host. Such a specimen, a species of *Hecalus* containing a larva of *P. cruciator*, is figured on Pl. VII, fig. 1.

When the larva of the *Pipunculus* quits its host, it usually escapes at the junction of the metathorax and abdomen, either below or above, the segments of the leaf-hopper being ruptured at that point. (Pl. VII, fig. 2). In the case of a *P. xanthocnemis*, however, the larva escaped from the *Liburnia* by a roundish hole in the mid-dorsal line, at about the middle of the length of the abdomen. This hole of exit is irregular, and has the appearance of having been gnawed, but I did not notice whether the larva that emerged was different from the usual type.

After escaping from its host, the larva as a rule buries itself beneath the soil, or beneath rubbish that lies on the surface; but in some species it pupates on the leaves of the tree or bush, on which the leaf-hopper was feeding, as in a case mentioned below, and in another recorded by Ott, who bred a *Pipunculus* from a puparium found on *Ribes*.

One peculiar feature in some species of *Pipunculus* is the fact that the surface of the abdomen often bears a number of depressions, frequently variable and of irregular form. Some species, such as *P. beneficiens*, appear to always have these on one or more of the segments and they are not due to post-mortem changes, as one might suppose without the examination of freshly caught specimens, but occur in every individual, at least of the male sex, though so variable in number and form. Indeed as a general rule they appear to be more commonly found, or are more developed, in the males than the females, and sometimes may even be said to produce a distortion of the body. Whether it is to some such examples that Verrall refers, when he says that he suspects the flies are themselves subject to parasites I do not know, but it is certain that the irregularities of surface mentioned above are not due to this cause, since they are found in every example of some common species, though only occasionally in others. *Pipunculus*, however, is subject to the attack of a Chalcidid parasite of the family Encyrtidae, of which I bred a species from the puparium of *P. cinerascens*, but whether the subterranean species are likewise attacked it may be very hard to prove, unless the parasite stings the larva of the *Pipunculus*, while still within the leaf-hopper. This I suspect is not the case, or we should probably have bred some of the Chalcids from the numerous species of *Pipunculus* that we reared from the larvae. The puparium of *P. cinerascens* being freely exposed on the surface of the leaves, would naturally be liable to be attacked, and is probably stung at that time. At least it is noteworthy that the one species with exposed puparium, and the only one of which puparia were collected, yielded a parasite, while the 15 species bred from larvae, but of which no puparia were collected, since all are subterranean, yielded no parasite.

I have begun these introductory remarks by saying that the Pipunculidae are small and obscure flies. I may conclude them by saying that this in no wise detracts from the interest awakened by their peculiarities of structure and habits. The enormous eyes, the almost unique mobility of the head, which is balanced on an acute point, and which reminds one of the similar mobility of the head in the keen-eyed dragon flies, leads one to suppose that vision plays a much more important part in seeking out the prey than do the other senses, while in those other parasites of leaf-hoppers, the Dryinidae, it is obviously by other senses than vision that their prey is chiefly hunted. One may further notice the large laminate pulvilli and slender elongate claws of the feet, (which remind one of these parts in some of the parasitic Conopidae), and especially the recurved, hard and strong sting of the females, which is always exserted.

LARVA AND PUPARIUM OF *PIPUNCULUS*.

The larva of *Pipunculus* is an acephalous maggot, pointed in front and elongate when extended, but capable of great contraction, by which means and by rolling movements it is able to make sufficient progression to enable it to find a suitable spot for pupation. The cuticle in the two species examined is corrugated or transversely furrowed, so that the true segmentation is with difficulty made out. The larva is amphipneustic, the anterior stigmata being small but distinct; the posterior spiracular area dark-coloured and very distinct, the spiracles or stigmatic scars being placed anteriorly and closely approximated, and the processes or tubercles, made conspicuous by their pale colour, situated at the sides. The mouth is a simple opening at the anterior extremity and without definitely chitinized parts, but internally by dissection a pair of more or less triangular and pointed, dark, chitinized pieces may be obtained. It is possible that these are sometimes extruded, but it is not the case with any of the preserved specimens I have examined. The anterior stigmata are placed a little behind the mouth opening. Larvae of about one-third the size of full-grown individuals do not differ materially from the latter, but only in size and shape, being frequently much more contracted or even almost globular. (For. fig. of larva, see Pl. VII, fig. 10, 10a, 10b).

The puparium is formed by the hardening of the larval cuticle, which becomes black, brown, or red in colour. In some species its surface has a dense and regular coriaceous, granular, or rugulose sculpture, most conspicuous in the case of *P. cinerascens*. In some puparia there is no difficulty in distinguishing the anterior stigmata of the larva, though they are extremely minute, but in others I fail to see them after the closest examination. Further back, however, on the dorsum there can be seen on each side a fine and minute process, apparently part of the puparium, in reality not so, but connected with the delicate cuticle of the enclosed pupa and merely perforating the puparium. When the fly emerges it frequently happens that one or other of these processes is dragged back through the hole in the puparium, but remains attached to the empty pellicle of the pupa. (Pl. VII, fig. 6).

The dark posterior stigmatic area is in many species deeply depressed, in others hardly at all, and bears one or more small tubercles on either side, in fact it bears much similarity to the same part in the larva. When the fly bursts from the puparium, the latter appears to be always ruptured along the same lines, in all the species we have examined, viz: along the front and hind margin of the dorsal segment, which bears the anterior processes, and along the hind margin of the ventral segment corresponding with this.

In the case of one species of *Pipunculus*, however, although the fly itself (*P. cinerascens*) is not very remarkable, the larval habits are unlike those of any of the other species, which infest arboreal leaf-hoppers, since this larva does not fall to the ground, and pupate beneath the soil, but forms its puparium in the open on the surface of living leaves. This puparium is very different from the subterranean ones, for instead of the minute anterior processes, are a pair of relatively enormous blunt ones, on the tip of each of which is a fine spine-like process. It is not quite clear to me whether the whole blunt process represents the minute one of subterranean species, and really belongs to the pupa, and not to the puparium; or whether the small apical spine-like piece alone represents these. Posteriorly the stigmatic area is large and deep, and instead of one or two minute tubercles on each side, there are three, the upper one being very large and conspicuous, the lowest one well separated from the upper two.

(For figures of puparia see Pl. VII, fig. 3, 4, 5, 5a, 5b, 6, 7, 8 and 9).

CLASSIFICATION.

Verrall divides the British species of *Pipunculus*, which are fair representatives of the European forms, into five groups. Three of these have a pigmented stigma and are divided as follows:

I. Abdomen quite dull, not even the margins shining, femora without any ciliation or pubescence behind.

II. Abdomen partly shining; femora ciliate or pubescent at least behind the middle pair; thorax and scutellum with dense but short pubescence.

III. Thorax and scutellum practically bare, as well as the femora; the abdomen considerably shining.

The other groups are without a pigmented stigma and are separated thus:

IV. Small or discal cross-vein far before the middle of the discal cell, eyes frequently not quite touching on the frons in the male.

V. Small cross-vein placed at or about the middle of the discal cell.

Both the Australian and Hawaiian species known to me divide into stigmated and non-stigmated sections, but the further division into groups on the characters used by Verrall is not very satisfactory, if indeed possible, with the species here considered. In the following table I have therefore used other characters for the groups.

Wings with a pigmented stigma.
  Stigma not bounded by a cross-vein at the base.
    Third antennal joint sharply pointed at the tip, usually acuminately produced.
      Basal abdominal segment with some black bristles on each side..I
      Basal abdominal segment with no trace of such bristles, and if pubescent, then the hairs similar to the general clothing II
    Third antennal joint rounded at tip, or at least not acute, and never acuminately produced.................III
  Stigma bounded by a distinct cross-vein at the base......IV
Wings without a pigmented stigma.

Small or discal cross-vein far before the middle of the discal cell V
Small cross-vein at or near the middle of the discal cell . . VI

One species in group VI is known in which the basal segment is entirely without lateral bristles; group IV is represented by a solitary minute species (though possibly the pair described are two, and not the sexes of one, species); while Group I contains several species in which the stigma is greatly lengthened, as compared with the fourth costal segment, somewhat resembling *Chalarus* and *Verrallia* in this respect; and some of these have the basal antennal joints rather more than usually bristly, though less so than in the latter genus. In other respects they are like ordinary *Pipunculus*. The Hawaiian species that are here described as new, belong to Group I; the double row of short spinules on the femora beneath are unusually well developed in these, as also are the marginal bristles of the scutellum and those on the basal abdominal segment; the bristles or fringe of hairs on the middle femora posteriorly are long and distinct in some males, but much less developed, and represented by soft hairs in such females, as are known.

LIST OF SPECIES OF *PIPUNCULUS* HERE DESCRIBED.

A. Australian species.
*1 *P. cruciator*, sp. nov.
*2 *P. eucalypti*, sp. nov.
*3 *P. erinys*, sp. nov.
*4 *P. hylaeus*, sp. nov.
5 *P. fallax*, sp. nov.
6 *P. dolichostigmus*, sp. nov.
7 *P. lamellifer*, sp. nov.
*8 *P. comitans*, sp. nov.
9 *P. agamus*, sp. nov.
*10 *P. cinerascens*, sp. nov.
*11 *P. beneficiens*, sp. nov.
*12 *P. helluo*, sp. nov.
*13 *P. Koebelei*, sp. nov.
*14 *P. monas*, sp. nov.
*15 *P. picrodes*, sp. nov.
*16 *P. anthracias*, sp. nov.
17 *P. crypsichalcus*, sp. nov.
18 *P. microdes*, sp. nov.

19 *P. homoeophanes*, sp. nov.
*20 *P. xanthocnemis*, sp. nov.
21 *P. heterostigmus*, sp. nov.
22 *P. leimonias*, sp. nov.
23 *P. epichalcus*, sp. nov.
*24 *P. synadelphus*, sp. nov.
*25 *P. pseudophanes*, sp. nov.
26 *P. nyctias*, sp. nov.
B. Hawaiian species.
*27 *P. juvator*, sp. nov.
28 *P. oahuensis*, sp. nov.
29 *P. terryi*, sp. nov.
30 *P. swezeyi*, sp. nov.
31 *P. hawaiiensis*, sp. nov.

All species marked with an asterisk have been bred.

SYNOPSIS OF SPECIES.

In this table 1-9 deal with individuals of both sexes; after the latter number the table becomes double, 11-41 dealing with males only, 43-60 with the females.

A. Australian species.

1 (10) Wings without a pigmented stigma.
2 (9) Small cross-vein at or near the middle of the upper side of discal cell.
3 (8) Basal abdominal segment with a short line of black bristles laterally.
4 (5) Abdomen shining, deep-black, with a distinct clothing of shortish black hairs conspicuous at the sides of the segments (female unknown).......*leimonias.*
5 (4) Abdomen more or less greenish-black or metallic, and with at most, excessively short, inconspicuous hairs.
6 (7) Larger, abdomen of male with the fifth segment without evident grey tomentum, and without short black hairs, tarsi black or piceous above; female, tarsi dark above ....*epichalcus.*
7 (6) Smaller, abdomen of male with the fifth segment more or less covered with grey tomentum, and having very short but distinct suberect hairs, tarsi more or less yellow (a little variable); female tarsi always for the most part yellow.............*synadelphus.*

8 (3) Basal abdominal segment without black bristles laterally. (Abdomen dull metallic green or at least submetallic, tarsi apparently variable, either black or dark above or yellowish.).........*pseudophanes.*

9 (2) Small cross-vein far before the middle of the upper side of the discal cell (Abdomen shining, blue-black) .... *nyctias.*

10 (1) Wings with a pigmented stigma.

11 (42) Males.

12 (13) Stigma enclosed by a cross-vein at the base...*heterostigmus.*

13 (12) Stigma not enclosed at base.

14 (15) Legs, except coxae and the apical joint of tarsi, yellow, unicolorous or nearly so........*xanthocnemis.*

15 (14) Legs more or less black or dark, at least on the femora.

16 (37) Antennae with the third joint always acutely pointed at apex, usually acuminately produced.

17 (26) Wings with the third and fourth costal segments subequal, or with the fourth never much shorter than third, sometimes the fourth is the longer.

18 (21) Basal abdominal segment at the sides with a short line of distinct black bristles, which are obviously different from any other hairs on the abdomen.

19 (20) Thorax and abdomen with fuscous tomentum; hypopygium above with a deep narrow channel on the right side. ....*cruciator.*

20 (19) Thorax and abdomen mostly black or blackish, the latter with whitish lateral tomentose spots; hypopygium on the right side at the tip with a more or less ovate dull area of peculiar texture....*eucalypti.*

21 (18) Basal abdominal segment without any special bristles at the sides; if hairy, then the hairs are similar to the general clothing.

22 (23) Whole body with pale erect soft hairs, which are long and conspicuous..................*eutrichodes.*

23 (22) Body not so clothed; hairs, where present, short and inconspicuous.

24 (25) Scutellum with a marginal fringe of fine, but quite distinct hairs; abdomen for the most part blackish on the dorsum, the surface not concealed under dense tomentum. ....*beneficiens.*

25 (24) Scutellum with a few excessively short hairs on margin, which are hardly visible; abdomen with dense fuscous tomentum on the dorsum over a large part of the surface.

25a (25b) Posterior tibiae dark except at extreme base; abdomen with the second and following segments black at the base, and with rather indistinct pale apical bands, narrowed or interrupted at the middle.*monas.*

25b (25a) Posterior tibiae entirely pale or partly infuscate; abdomen with dark fuscous tomentum, not banded above.

25c (25d) Posterior tibiae almost uniformly yellowish..*koebelei.*

25d (25c) Posterior tibiae more or less infuscate in parts..*helluo.*

26 (17) Wings with the third costal segment much longer than the fourth, sometimes twice as long.

27 (28) Whole body nearly uniformly covered with cinereous tomentum. . ...*cinerascens.*

28 (27) Body not so clothed; more or less variegated with black and grey or whitish tomentum.

29 (30) Tarsal joints black above..................*hylaeus.*

30 (29) Tarsal joints pale, except the apical joint.

31 (34) Larger and robust species (length over 4 mm.) apical margin of scutellum fringed with some longish and very distinct hairs.

32 (33) Hypopygium with a thin outstanding rounded lamella...................................*fallax.*

33 (32) Hypopygium with an elongate, dull area marked out, but no strong lamella.............*dolichostigmus.*

34 (31) Smaller species (length under 4 mm.) apical margin of the scutellum with only a few very short fine hairs, easily overlooked.

35 (36) Hypopygium with a thin lamella strongly outstanding............................ ....*lamellifer.*

36 (35) Hypopygium with an elongate channel or impression, but without a strong lemella............*comitans.*

37 (16) Antennae with the third joint not sharply pointed at apex, nor acuminately produced.

38 (39) Abdomen except towards the base entirely shining, somewhat aeneous, and not variegated with tomentum................................*crypsiohalcus.*

39 (38) Abdomen more or less variegated with pale and dark bands or spots.

40 (41) Antennae with pale third joint; basal abdominal segment entirely black above, or almost so...*microdes.*
41 (40) Antennae with the third joint dark; basal abdominal segment with a pale apical band of tomentum.................................... *homoeophanes.*
42 (11) Females.
43 (44) Stigma closed at base by a transverse vein.................................... *heterostigmus.*
44 (43) Stigma not so closed at base.
45 (58) Antennae with the third joint more or less produced acutely at the apex, often strongly acuminate.
46 (53) Basal abdominal segment with a line of black bristles on either side, distinct from hairs of the general surface, if such be present.
47 (48) Tarsi black or dark above..................*crinys.*
48 (47) Tarsi except apical joint pale.
49 (52) Face between ocelli and antennae almost entirely hidden by a dense covering of tomentum.
50 (51) Almost the whole body evenly covered with cinereous tomentum, ovipositor straight or nearly so..*cinerasceus*
51 (50) Thorax and a large part of abdomen with fuscous tomentum; ovipositor distinctly curved from base to apex. ....*cruciator.*
52 (49) Face between the ocelli and antennae bare and shining, except close to the antennae.........*agamus.*
53 (46) Basal segment of abdomen without a lateral line of distinct black bristles.
54 (55) Whole body with a conspicuous clothing of fine, erect, pale and rather long hairs.......*eutrichodes.*
55 (54) Body not so clothed.
56 (57) Abdomen black, more or less shining and sparsely tomentose. .... *beneficiens.*
57 (56) Abdomen covered with dark fuscous tomentum with grey lateral spots.
57a (57b) Second abdominal segment with an entire basal band of whitish-grey tomentum................*picrodes.*
57b (57a) Second segment without such a band.
57c (57d) Posterior tibiae almost uniform yellowish, not infuscate in middle; ovipositor longer........*koebelei*
57d (57c) Posterior tibiae more or less infuscate about the middle; ovipositor shorter.....................*helluo.*

58 (45) Antennae with the third joint more or less rounded and not acutely produced at the apex.

59 (60) Legs except the coxae clear yellow....*xanthocnemis.*

60 (59) Legs largely black, or dark brown........*anthracias.*

B. Hawaiian species.

1 (2) Wings without a pigmented stigma.................. .... *rotundipennis, Grimsh.*

2 (1) Wings with a pigmented stigma.

3 (6) Posterior tibiae with some specially developed bristles on the median dilatation outwardly.

4 (5) Legs except the coxae entirely pale, yellow........ ....*hawaiiensis.*

5 (4) Legs largely black on the femora, and the tarsi also dark .... *oahuensis.*

6 (3) Posterior tibiae without special bristles on the median dilatation outwardly.

7 (8) Legs except coxae entirely pale, yellow.....*swezeyi.*

8 (7) Legs with the femora at least more or less black or fuscous.

9 (12) Hind legs with a more or less distinct median dark band on the tibiae.

10 (11) Third joint of antennae, and tarsi pale............ ....*molokaiensis, Grimsh.*

11 (10) Third joint of antennae, and tarsi dark............. ....*nigrotarsatus, Grimsh.*

12 (9) Hind legs without a median dark band on tibiae, sometimes darkened towards base and apex, but the middle always pale.

13 (14) Abdomen of male for the most part deep-black or blue-black, femora of the female black above for the most part, the base and apex for a short distance yellow. ....*juvator.*

14 (13) Abdomen of male for the most part blackish-fuscous, with a slight aeneous tint in some aspects; femora of the female to a large extent yellow, somewhat infuscate, but not black, on the apical half...*terryi.*

DESCRIPTION OF SPECIES.

In the descriptions of the species not much stress need be placed on the exact colours of the pale tomentose spots or bands, whether whitish, greyish, or slightly flavescent as they are hard to discriminate and not constant The same may be said of the measurements, which vary much in some species and are subject to error owing to contraction or curvature of the body after death.

A. Australian Species.

1. *P. cruciator*, sp. nov.

Head black; between the ocelli and antennae, and the face below these, almost entirely covered with white tomentum in the female, as is the whole front and face in the male; posteriorly with fuscous tomentum, becoming grey at the sides, and finely ciliated. Antennae with the two basal joints black or piceous; the third yellow, sometimes sordid or obscured, in the male pointed at the tip, in the female more strongly and acuminately produced. In the latter sex even the basal antennal joints are sometimes yellowish, though possibly only in immature examples.

Thorax above covered with fuscous tomentum, greyer on the metathorax and pleura; scutellum with a sparse marginal fringe of very short fine hairs; halteres yellow, blackish or fuscous at base. Wings subinfuscate, stigma yellowish brown, third and fourth costal segments subequal. Legs with the coxae, femora, the apical joint of tarsi, and tips of claws, black or dark; the rest of tarsi, the trochanters, the apex and usually the base of femora, as well as the tibiae yellow; the latter often more or less darkened or brownish in parts. The hairs on the legs are extremely short, and placed in rows.

Abdomen covered with fuscous tomentum, more or less grey or yellowish grey on the apical margins of the segments, or at least on the sides of some of the apical segments in the male; in the female the abdomen usually has a distinct pattern, the grey tomentum on the third, fourth and fifth segments, forming a wedge-shaped lateral mark, leaving a large triangular fuscous area on the disc, the second segment being grey with a fuscous discal spot. Basal segment with a line of 3-5 conspicuous black bristles on each side. Hypopygium of male deeply channeled on the right side, and shortly and finely pilose; at the tip with a large fovea or impression. Ovipositor distinctly curved from base to tip. Length 3.25-5 mm. (Pl. V, fig. 126, VII, fig. 1, 6, 7.)

HAB. Cairns district, on the coast and in the mountains; bred several times from a species of *Hecalus*, (Koebele's specimens are numbered 2268) and also by Mr. Koebele from a very different Jassid nymph (No. 2275).

2. *P. eucalypti*, sp. nov.

Male: Head in front, and face, with glistening white tomentum; behind the eyes in the middle with dark, at the sides with whitish. Antennae dark, black or blackish; third joint pitchy, pointed at the apex, but hardly produced.

Thorax dull black, with thin fuscous tomentum, in front laterally, the metanotum, and the pleura, with white or greyish white; the scutellum with fine marginal hairs, which are quite easily seen, being considerably longer than the few that are on the disc. Wings nearly clear, neuration dark, stigma brown, third and fourth costal segments subequal, posterior cross-vein very oblique, its upper extremity about opposite the apex of the second longitudinal; halteres largely pale, dark basally. Legs black or pitchy, knee-joints pale, tarsi above yellow or yellowish brown, but sometimes appearing dark from the many short, black hairs; tibiae more or less brownish or yellowish.

Abdomen black, with some fuscous tomentum, and with whitish lateral tomentose spots, as well as an apical band on the basal segment; the latter with the usual lateral row of bristles; all the segments with shortish hairs, very distinctly outstanding from the side of each; hypopygium with a subovate or subtriangular apical area, very dull, and of different texture from that of the rest of the segment. Length 4 mm. (Pl. V, fig. 4.)

HAB. Bundaberg; one male bred from the nymph of a Jassid on *Eucalyptus* by Mr. Koebele (2297); by a slip of the pen recorded in his notes (under this number) as being bred from a Fulgorid.

3. *P. crinys*, sp. nov.

Female; head black, bare for about half the distance from the ocelli to the antenna, the face and front being covered with white, glistening tomentum; posteriorly with whitish tomentum at the sides, in the middle more fuscous. Antennae black or dark, the third joint acuminate, blackish or pitchy, evidently, though not very strongly, produced at the apex.

Thorax dull black, sparsely covered with fuscous tomentum, in front laterally and on the pleura with whitish grey tomentum, with which the metathorax is also covered; scutellum with a few very fine marginal hairs, not at all conspicuous; halteres blackish. Wings with the neuration, except at the base, where it is paler, black or nearly so; stigma distinct but rather pale, about as long as the fourth costal segment; small or discal cross-vein opposite apex of auxiliary; second longitudinal vein terminating nearly opposite, or a little beyond, the upper extremity of the posterior cross-vein. Legs black, the knee-joints, pulvilli and claws (except apically) pale, the tarsi black or at least dark above, but paler beneath, the hairs of the legs and feet black.

Abdomen more or less transversely wrinkled, black, with wedge-shaped marks of whitish grey tomentum on the third, fourth and fifth segments; first and second with whitish grey tomentum, the disc of the latter being black, sixth nearly entirely covered; basal segment with a few black tristles on each side. Ovipositor straight. Length 3.75 mm.

HAB. Bundaberg, Queensland; bred from a common Jassid on *Melaleuca*.

4. *P. hylaeus*, sp. nov.

Male: Head in front and face with dense white tomentum; posteriorly behind the eyes with dark in the middle and whitish at the sides. Antennae black, the third joint pitchy black, acute at the tip, but hardly produced.

Thorax dull black, with sparse fuscous tomentum, in front at the sides and on the pleura with whitish, as also on the metanotum; scutellum with a few very short and fine, hardly perceptible, marginal hairs; halteres sordid fuscous. Wings hyaline, hardly smoky, neuration dark, stigma pale, brownish-yellow, third costal segment about twice as long as the fourth, upper extremity of posterior cross-vein nearly opposite (or a little before) the termination of second longitudinal. Legs black, base of tibiae yellowish, the hind tibiae with some hairs outwardly about the middle, which, though short, are longer than the general clothing.

Abdomen black, transversely wrinkled, the apical margins of the segments paler and more shining in some aspects, and with whitish tomentum, especially laterally; basal segment with distinct lateral bristles, second with a few short hairs; hypopygium with sparse and very short hairs, more or less impressed at the base towards the right side, and also with a terminal impression. Length 3.5-4 mm. (Pl. V, fig. 7, Pl. VII, fig. 8.)

HAB. Bundaberg, Queensland; bred from two species of Jassids, Mr. Koebele's specimen, numbered 2321, being reared from a very different species of leaf-hopper from one which yielded me the same fly.

5. *P. dolichostigmus*, sp. nov.

Male; front and face with silvery grey or whitish tomentum, as also the head posteriorly. Antennae pitchy black, the third joint paler, but sordid, distinctly produced acuminately at the apex.

Thorax black, with fuscous tomentum, at the sides in front and on the pleura more grey, the metanotum covered with whitish; scutellum with sparse hairs, those on the hind margin twice as long as those on the disc; halteres sordidly pale, black at the base. Wings with the neuration blackish, paler at base, stigma pale brown, about twice as long as the fourth costal segment, small cross-vein about opposite the apex of the auxiliary vein, posterior cross-vein very oblique, its upper extremity about opposite the apex of the second longitudinal vein. Legs with the coxae black, trochanters (more or less), apex and base of femora, tibiae for the most part, tarsi except the apical joint, yellow; posterior tibiae about the middle at the thickening with two or three longish hairs outwardly.

Abdomen with very short suberect hairs; the second, third, fourth and fifth segments deep black at base, with greyish tomentum apically, as on the whole of the basal segment, which has a transverse row of 8 or 10 black bristles at the sides; the second segment at the sides with some weak black hairs; hairs on the abdomen mostly pale. Hypopygium with a narrow elongate area, the surface of which is dull and of peculiar texture. Length 4.75 mm.

HAB. Bundaberg, Queensland. One example captured.

6. *P. fallax*, sp. nov.

In all respects like the preceding, but with the hypopygium bearing a prominent thin lamella, the edge of which, seen in profile, is rounded. Length 4.75 mm.

HAB. Bundaberg, Queensland. One male captured.

7. *P. lamellifer*, sp. nov.

Male; head in front and face with glistening whitish tomentum, as also posteriorly at the sides, between which it is more fuscous. Antennae with the third joint distinctly and sharply acuminately produced, and piceous or obscurely pale.

Thorax covered with fuscous tomentum, at the extreme front generally with some more or less evident pale tomentose spots, the pleura with greyish, the metanotum covered with whitish tomentum, the scutellum with some very inconspicuous and short hairs. Wings fuscous tinted, third costal segment considerably longer than the fourth, the small cross-vein rather beyond the apex of the auxiliary. Legs black or pitchy, knee-joints and tarsi yellowish, the apical joints of the latter dark, tibiae for the most part brownish above.

Abdomen with blackish tomentum forming great subtriangular discal markings, the rest of the surface being occupied by grey or whitish tomentose lateral spots; basal segment with whitish or grey tomentose band, and with a distinct lateral line of black bristles on each side; hypopygium with a large, outstanding, thin lamella. Length 3 mm. (Pl. VI, fig. 2.)

HAB. Cairns district; coast and mountains.

8. *P. comitans*, sp. nov.

Like the preceding in almost all respects, but the hypopygium has an elongate cleft or depression, instead of the thin outstanding lamella.

HAB. Cains district, in the same localities as the preceding. One specimen (2283) was bred by Mr. Koebele from the male of a Jassid living on grass, and I obtained one from a female Jassid of probably the same species.

9. *P. agamus*, sp. nov.

Female; head black, shining and bare in front of the ocelli, the face and front being covered with glistening white tomentum, antennae with the third joint strongly and very sharply, acuminately produced, its colour piceous or obscurely pale.

Mesonotum covered with fuscous tomentum, at the sides in front (more or less) and the pleura and metanotum with whitish grey; scutellum with some very short and indistinct hairs; halteres pale, dark at base. Wings nearly clear, third costal segment generally distinctly longer than the fourth, but a little variable; small cross-vein rather beyond the apex of the auxiliary; posterior cross-vein very oblique, its upper extremity beyond the apex of the second longitudinal; stigma pale brown. Legs dark, the knees and tarsi (except the apical joint) yellow, the tibiae largely dark or brown.

Abdomen with dark fuscous tomentum, and lateral spots of greyish white, the basal segment with a lateral line of distinct black bristles, and with a band of whitish tomentum; ovipositor straight, longer and slenderer than in most Australian species. Length 2.5-3 mm.

HAB. Cairns district, with the two preceding. Without doubt it is the female sex of one of these, but as it differs in important characters from both, and it is impossible to associate it specially with either, I have temporarily given it another name.

10. *P. cinerascens*, sp. nov.

Head in front, and the face covered with dense glistening whitish tomentum; posteriorly at the sides with whitish, in the middle with darker grey. In the female the dense tomentum of the face extends back to the ocelli. Third joint of the antennae yellow, and very strongly acuminately produced at the apex.

Thorax with slate-coloured tomentum; in front laterally, the pleura and the metanotum with whitish; the scutellum with some very fine, short and inconspicuous hairs; halteres yellow, dark at base. Wings extremely clear, neuration dark, stigma pale brown, third costal segment much longer than the fourth, upper extremity of the posterior cross-vein about opposite the apex of the second longitudinal. Legs black, femora and tibiae with pale tomentum, knee-joints and tarsi (except the apical joint) yellow, tibiae largely brownish or darkened.

Abdomen nearly uniformly covered with whitish slate-coloured tomentum, the basal segment with a line on each side of several longish and distinct black bristles; hypopygium of male with a large apical impression on the right side; ovipositor of the female nearly straight and not very long. Length 3 mm. (Pl. V, fig. 2, VII, fig. 4 and 9.)

HAB. Bundaberg, Queensland; bred freely from puparia on the leaves of *Melaleuca.*

11. *P. beneficiens*, sp. nov.

Head with the front and face covered with glistening white tomentum, in the female black, bare and shining in front of the ocelli, posteriorly with greyish white tomentum on each side and fuscous between. Antennae black or piceous, the third joint acuminate and strongly produced at the apex, variable in colour usually more or less yellowish, but sometimes wholly dark or wholly yellow, in the female often of the latter colour, but even in this sex it is sometimes dark.

Thorax with thin fuscous tomentum, in front laterally and the pleura more or less grey, the metanotum with denser grey or whitish tomentum; the scutellum with extremely fine marginal hairs, the surface more or less shining, in some aspects at least; halteres pale, dark at base. Legs black, tip of femora, the tibiae and tarsi (except the apical joint) yellow, the tibiae more or less black or infuscate in part. Wings in the male distinctly smoky, clearer in the female, neuration blackish, paler towards base of wing, stigma distinct, obscure brown, about as long as the fourth costal segment, small cross-vein opposite the apex of the auxiliary, and at about the basal third of the upper side of the discal cell.

Abdomen black, often somewhat shining in the male, and clothed with short sparse hairs, at the sides with greyish white tomentum, which in fresh specimens also forms a band on the basal segment; some or most of the segments generally with depressions of varying form and often irregular; hypopygium large, with a transverse basal impression and with a shining hairless lobe on the right side, which extends beneath to the genital armature itself. In the female the abdomen is generally like that of the male, black and more or less shining, with white tomentum laterally, and more or less evidently on the dorsum of the first or of the two basal segments, the surface usually with few or no depressions, the ovipositor straight; basal segment in both sexes with no trace of a line of bristles laterally. Length 2.25-3.25 mm. (Pl. V, fig. 3; VI, fig. 3.)

HAB. Common throughout Queensland; bred from a Jassid, 2291, by Mr. Koebele, and by myself from very different species.

12. *P. helluo*, sp. nov.

Head with the front and face covered with glittering white, or whitish, tomentum, behind the eyes with grey at the sides, and between with dark fuscous. Antennae black or piceous, third joint acuminately produced at the apex and apparently always dark in colour. Mesothorax with rather dense fuscous tomentum; at the sides in front and the pleura with grey or whitish; the metanotum densely covered with whitish tomentum; scutellum with a few hairs, so short and fine, as to be seen with difficulty; halteres yellowish-brown or testaceous, dark at base. Wings somewhat smoky, clearer in the female, the neuration black or very dark brown, paler at the base, stigma obscure brown, subequal to the fourth costal segment, or rather shorter, small cross-vein opposite the apex of the auxiliary. Legs black or pitchy, the apex of femora, the tibiae (which, however, are more or less dark or infuscate in parts) the tarsi (except the apical joint) yellow or yellowish.

Abdomen with dense and even, dark fuscous tomentum, and greyish wedge-shaped lateral tomentose spots, the basal segment more or less evidently grey-banded, and with no line of bristles on each side; the dorsum often with more or less evident, and often irregular, impressions on one or more segments, the surface not noticeably pilose; hypopygium of the male large, with sparse and very short, inconspicuous hairs, somewhat shining in some aspects, impressed (often irregularly) at the base, and with a distinct lateral lobe on the right side, which is not covered with tomentum. Ovipositor of female straight or nearly so. Length 2.5-3.5 mm.

HAB. Bundaberg, Queensland, bred from nymphs of Siphanta sp. on several occasions. Mr. Koebele bred this species from another genus of Poecilopterine Fulgorids, found on *Ricinocarpus* at Sydney, N. S. W. (No. 2362); his number for Bundaberg was 2326.

13. *P. Koebelei*, sp. nov.

This species agrees in almost every way with *P. helluo*, but I have no doubt it is distinct in spite of the extraordinary resemblance between the two, since in the male the small hairless lobe on the right-side of the great hypopygium in this species is subtomentose, the hind tibiae are almost uniform yellowish in both sexes, not brownish or infuscate in the middle, and the ovipositor of the female is very decidedly longer. Antennae dark, but the third joint more or less pale in the female, at least apically. Length 2.75-3.5 mm. (Pl. VII, fig. 5.)

HAB. Sydney, New South Wales, Nos. 2373 and 2395 of Koebele, who bred it from a Jassid found on the sandhills.

14. *P. monas*, sp. nov.

Male; head in front, and face with white tomentum; posteriorly with fuscous, more greyish laterally; antennae black, third joint acuminately produced, dark, but with paler tip.

Mesonotum covered with fuscous tomentum, and with two whitish spots in front, the pleura and metanotum whitish tomentose; scutellum with excessively minute, hardly visible hairs; wings slightly smoky, stigma as long as the fourth costal segment, small or discal cross-vein about opposite the termination of the auxiliary, and far before the middle of the discal cell; legs black, extreme tip of femora and the base of tibiae yellowish, front and middle tarsi black or dark above, the posterior apparently more or less pale.

Abdomen dull, basal segment black, with a distinct apical pale tomentose band, and with no trace of bristles laterally, the following segments black basally, but with pale apical bands, widest at the sides, and either narrowed or interrupted in the middle. Hypopygium large, sparsely tomentose, and with the surface shining, and with a very few excessively short (almost invisible) hairs. Length 3 mm.

HAB. Bundaberg, Queensland; one male bred by Mr. Koebele (2333) from a common Jassid. Very distinct in its group by the dark tibiae and abdominal pattern.

15. *P. picrodes*, sp. nov.

Female: general appearance and structure as in the two preceding species, but of larger size, the lateral grey tomentose spots of the abdomen large and distinct, though hardly visible on the dorsum, basal segment with the grey tomentose apical band narrower than in the female of *P. Koebelei*, and the second segment with a distinct and entire basal band, which occupies half the segment or more and is narrowed at the middle. Posterior tibiae yellow, hardly darkened in the middle, except beneath. Third joint of the antennae clear yellow, not at all infuscate even basally. Ovipositor moderate, probably relatively longer than in *P. helluo*, shorter than in *P. Koebelei*. Length 3.5 mm.

HAB. Sydney, N. S. W.; bred from a Jassid on *Leptospermum* (Koebele No. 2351).

16. *P. anthracias*, sp. nov.

Female. Head in front and the face black, with little or no tomentum, the face extremely narrow, the inner margins of the eyes nearly touching, much closer together below than above the antennae; the latter dark, blackish or dark fuscous, the third joint in side view rounded at the apex, not acuminate; behind the eyes the head has fuscous tomentum, greyish at the sides.

Thorax thinly covered with fuscous tomentum, and somewhat shining; at the sides in front and on the pleura with whitish, the metanotum densely covered with the same; scutellum with very sparse, fine, inconspicuous hairs. Wings distinctly smoky, neuration blackish, paler at base, stigma brown, subequal to, or a little shorter than, the fourth costal segment, the posterior cross-vein before the apex of the second longitudinal. Legs black or piceous, knees pale, tarsi sometimes yellow, but generally more or less obscure, or fuscous, above; tibiae for the most part brownish or fuscous.

Abdomen with the two first and basal part of the third segment densely covered with whitish tomentum, the rest shining black, with sparse short hairs; basal segment on each side with a short row of a few distinct black bristles; ovipositor straight. Length 2-2.5 mm. (Pl. V, fig. 9.)

HAB. Kuranda, and Cairns, Queensland; one was bred by Mr. Koebele from (?) *Thamnotettix* (No. 2339), the others were captured specimens.

17. *P. crypsichalcus*, sp. nov.

Male: face below the antennae excessively narrow, black and hardly tomentose, the front with whitish tomentum, as also the head posteriorly at the sides. Antennae with the third joint yellow, not sharply pointed at the apex.

Thorax shining, blackish aeneous, with some whitish tomentum at the sides in front and on the pleura, more densely tomentose on the metanotum; scutellum with extremely fine, short marginal hairs; halteres pale in the middle, dark at base, and more or less so on the apical portion. Wings distinctly clouded, stigma dark brown, not reaching back to the apex of the auxiliary vein, third costal segment as long as the fourth, small cross-vein well beyond the apex of the auxiliary, the upper extremity of the posterior cross-vein a little before the apex of the first longitudinal. Legs black or dark; the apex of femora, the tibiae and tarsi (except the apical joint) yellow or pale, the tibiae more or less darkened with brown or fuscous.

Abdomen shining, aeneous, more piceous or brownish towards the base, blacker apically, the basal segment and the second (more or less) clothed with grey tomentum; hypopygium twisted to the right, impressed at the base, and with a definite area or impression at the tip, within which the surface appears to be paler in colour. Length 2.5 mm.

HAB. Kuranda, near Cairns, N. Queensland.

18. *P. microdes*, sp. nov.

Male: head with the eye-margins touching for about half the distance from the ocelli to the antennae, the front and face black, with little or no pale tomentum, space between the eyes beneath the antennae extremely narrow; head posteriorly with fuscous tomentum, becoming whitish at the sides. Antennae with the third joint pale, not at all acute at the tip.

Thorax somewhat shining, and covered, but not densely, with fuscous tomentum the metathorax densely clothed with grey; scutellum with a few short and extremely fine marginal hairs. Halteres pale, dark at base. Wings somewhat smoky, third costal segment as long as, or rather longer than, the fourth; posterior cross-vein hardly oblique, its upper extremity before the termination of the second longitudinal. Legs with the trochanters, base and apex of femora, tibiae and tarsi nearly entirely, yellow.

Abdomen deep black on the three basal segments, the second and third with lateral spots of grey tomentum, two following segments in some aspects smooth and shining, somewhat metallic, but seen, in some views, to bear a thin covering of pale tomentum; basal segment at the sides apparently with only one or two bristles, which are not easily seen. Hypopygium impressed at the base and bent to the right, the tip with a large distinct impression. Length 2 mm. (Pl. V, fig. 5.)

HAB. Kuranda, near Cairns, N. Queensland.

19. *P homoeophanes*, sp. nov.

Male: front of head and face black, the surface not concealed by pale tomentum, but nearly bare; posteriorly the head is dark, but greyish tomentose at the sides. Antennae with the third joint dark, not acutely pointed at the apex.

Thorax with fuscous tomentum, more greyish at the sides in front, and on the pleura, denser and grey on the metanotum; scutellum at the most with a few excessively short fine hairs, very indistinct; halteres pale, dark at base. Wings subinfuscate, neuration black, stigma brown, third and fourth costal segments not differing much in length, upper extremity of posterior crossvein before the apex of the second longitudinal. Legs pitchy, knee joints and tarsi paler, brownish or brownish yellow.

Abdomen deep black, with pale lateral spots, which on some segments unite to form apical bands; fifth segment shining in some aspects, as probably are the other parts occupied by pale spots, if the tomentum be removed; basal segment on each side with about three black, longish bristles; hypopygium bent to the right and the tip with a large impression. Length 2.5 mm.

HAB. Kuranda, near Cairns, N. Queensland.

20 *P. xanthocnemis*, sp. nov.

Head in front and the face with white or greyish white tomentum; in the female for half the distance from the ocelli to the antennae black, bare and shining; posteriorly fuscous in the middle, grey laterally. Antennae with the third joint yellow, not sharply pointed at the tip, nor at all produced.

Thorax somewhat shining, nigroaeneous, beneath a thin covering of fuscous tomentum, metanotum much more densely clothed with greyish white; scutellum with extremely short and fine marginal hairs; halteres pale, dark at base. Wings hardly clouded, third costal segment in the male distinctly longer than the fourth, but in the female the difference in length is less, and in one specimen the fourth is fully as long as the third; posterior cross-vein oblique, its upper extremity about opposite the apex of the first longitudinal. Legs, except the coxae, nearly uniformly clear yellow.

Abdomen black, bare and shining in the male, and more or less aeneous, the first segment with more or less distinct tomentum; in the female more tomentose, especially the first two segments, and sometimes hardly aeneous; basal segment with a short lateral line of a few black bristles. Length 2-3.25 mm. (Pl. V, fig. 8.)

HAB. Cairns district and Bundaberg; bred from a *Liburnia.*

21. *P. heterostigmus*, sp. nov.

Head with the front and face in the male with whitish tomentum; in the female the tomentum between the ocelli and antennae is divided by a shining and bare, black carina; face beneath the antennae extremely narrow; head posteriorly with fuscous tomentum becoming whitish towards the sides. Antennae with the apical joint somewhat pointed at the tip, but not sharp, nor produced, yellow in the female, sordid or pitchy in the male.

Thorax with fuscous tomentum in the male, greyish or whitish fuscous in the female; on the metathorax with dense white covering. Halteres yellow, dark at the base. Wings with dark neuration, stigma yellowish brown, and enclosed on the basal side by a strong cross-vein third costal segment considerably longer than the fourth, posterior cross-vein before the apex of the second longitudinal. Legs for the most part yellowish in the female, but the femora are largely darkened above and at the sides; in the male the legs are altogether darker, the trochanters, knee-joints and tarsi mostly yellowish, the tibiae for some part more brown.

Abdomen sparingly tomentose, and without pattern; on the basal segments more or less pallid, brownish or yellowish, but darker posteriorly the apex being blackish; basal segment with two or three bristles on each side. Length about 2 mm. (Pl. V, fig. 10.)

HAB. Redlynch and Kuranda near Cairns. A single male and female in each case, taken from boughs of trees, so that it probably attacks arboreal leaf-hoppers.

22. *P. synadelphus*, sp. nov.

Black, with always more or less of an aeneous tinge, and generally very distinct dull brassy. Front of head and face with dense white tomentum; in the female the space between the eyes in front of the ocelli is rather shining and conspicuously impressed, and bears very little tomentum compared with the front. Antennae with the third joint acuminate, and more or less pale apically.

Thorax with not very dense fuscous tomentum, and with a pale spot on each side in front; the metanotum with dense whitish grey tomentum; scutellum with at most a few hardly visible hairs; halteres yellow, black at base. Wings clear, third costal segment very short, not stigmated; small cross-vein beyond the apex of the first longitudinal, at or rather beyond the middle of the upper side of discal cell; posterior cross-vein very oblique, its upper extremity beyond the apex of the second longitudinal. Legs black, knees and tarsi pale.

Abdomen with a band of tomentum on the basal segment, and with a line of distinct black bristles on each side; elsewhere sparsely tomentose, and with very short black hairs, which are quite easily seen; hypopygium of male somewhat tomentose and with sparse and excessively short hairs, which are less conspicuous than those on the preceding segment; ovipositor of female straight and slender. Length 25-3 mm. (Pl. VI, fig. 4.)

HAB. Bundaberg, Queensland, common; also at Cairns, and Mr. Koebele bred one specimen from a Jassid taken on grass at Childers (2319).

23. *P. epichalcus*, sp. nov.

Aeneous, the abdomen in the female more or less copper-coloured; front and face with greyish or white tomentum, which in the female extends back to the ocelli; posteriorly the head at the sides has whitish tomentum; antennae dark with the third joint acuminate, and at the most only sordidly pale.

Thorax with a pale spot on each side in front, and with whitish (or subflavescent) tomentum on the pleura and sides of the metanotum, elsewhere hardly tomentose; scutellum with a few scarcely visible hairs; halteres pale, dark at base. Wings hyaline, hardly infuscate, third costal segment very short, not stigmated, small cross-vein near the middle of the upper side of the discal cell and beyond the apex of the first longitudinal; posterior cross-vein oblique, its upper extremity beyond the termination of the second longitudinal. Legs black, tip of femora and base of tibiae yellow, tarsi dark above, black or piceous.

Abdomen of the male sometimes more or less shining, generally duller in the female, basal segment with a band of white tomentum, and with a few black bristles on each side, elsewhere nearly bare. Hypopygium of the male with a great impression at the tip; ovipositor of the female very slightly curved. Length 3.25-3.5 mm.

HAB. Cairns, Queensland; two or three specimens captured, but not bred.

24. *P. pseudophanes*, sp. nov.

In almost every respect like the preceding, but less brightly aeneous, and at once distinguished by the fact that the basal abdominal segment is without the line of black bristles on each side. The legs in this species appear to vary in colour, the tarsi being generally black or brown above, but in one specimen they are yellow. Length 3.25-3.75 mm.

HAB. Cairns, Queensland; on the coast and in the mountains; one example was bred from the same Jassid (a species of *Hecalus*) as *P. cruciator*.

25. *P. leimonias*, sp. nov.

Male; front of head, and face with white tomentum, as also the head posteriorly at the sides; third joint of antennae strongly acuminate, blackish or pitchy.

Thorax very thinly tomentose, with a pale spot on each side in front; the metanotum more densely covered with whitish tomentum, especially at the sides; halteres whitish, black on the basal half; mesonotum and scutellum with short and fine but quite noticeable erect hairs. Wings nearly clear, third costal segment very short, and not stigmated; small cross-vein near the middle of the upper side of discal cell, and beyond the apex of the first longitudinal vein; upper extremity of posterior cross-vein beyond the termination of the second longitudinal. Legs black, knee joints yellow, tarsi black or pitchy above.

Abdomen blue-black, sparsely but quite conspicuously clothed with short black hairs; basal segment without a band of pale tomentum, but with the bristles well developed on each side; hypopygium with greyish-fuscous tomentum, impressed or channeled. Length 3 mm.

HAB. Brisbane, Queensland.

26. *P. nyctias*, sp. nov.

Deep black, or blue-black; front, face, and head at the sides posteriorly with dense white tomentum; antennae with pale third joint, acuminate at apex.

Thorax more or less shining, and thinly clothed with fuscous tomentum, that on the metanotum white, and dense at the sides; scutellum with scarcely visible hairs; a pale spot on either side of the thorax in front. Wings subinfuscate, but darker in some examples than in others, third costal segment very short, and not stigmated; fourth costal segment also short, but longer than the third; small cross-vein about opposite the extremity of the first longitudinal, and considerably before the middle of the upper side of the discal cell; upper extremity of posterior cross-vein far beyond the apex of the second longitudinal. Legs black, apex of femora, tarsi, and tibiae yellow, the latter more or less dark in the middle, trochanters sometimes more or less pale.

Abdomen blue-black, shining; the basal segment with whitish or grey tomentum, and a line of black bristles on each side; elsewhere the abdomen with sparse and very short dark hairs, most noticeable towards the apex; hypopygium of male with a large cleft or impression, ovipositor relatively long. Length 2.5-2.75 mm. (Pl. VI, fig. 5.)

HAB. Cairns and Bundaberg, Queensland.

B. Hawaiian Species.

27. *P. juvator*, sp. nov.

Black, the face and front with whitish, or grey tomentum, more obscure and fuscous in some examples, head shining and bare in front of the ocelli in the female; antennae very variable in colour, entirely black, or with the third joint, which is acuminately produced, piceous, sordid yellow or even entirely clear yellow rarely of the latter colour in the male, the tendency being to a paler colour in the female, in which, however, the antennae are sometimes entirely dark.

Thorax dark, more or less shining, and sparsely clothed with fuscous tomentum, the metanotum more densely with whitish or grey; the scutellum with a marginal series of distinct longish bristles; halteres pale, dark at base; wings blackish smoky in the male, clear in the female, stigma brown, small cross-vein about opposite, or a little beyond the apex of the auxiliary, and well before the middle of the discal cell; posterior cross-vein very oblique. Legs with coxae and femora black, the latter more or less distinctly yellow at base and apex, and beneath with two rows of short spines or spinose hairs at least on the apical part; tibiae yellow, sometimes darker towards the base and on the apical portion, but yellow in the middle, the posterior pair with no specially long hairs on the dilatation; tarsi nearly always black, brown, or fuscous above in the male, sometimes black in the female but often largely yellow, as is rarely the case in the former sex.

Abdomen in the male deep black or bluish black, shining (at least apically) and bearing short black hairs; the basal segment with a band of grey tomentum, and a transverse row of long black bristles at the sides; in the female the abdomen is distinctly covered with grey tomentum, most densely on the apical portion of the first segment, and bears short and sparse, but quite evident, dark hairs. Length 3-4.75 mm. (Pl. VI, fig. 1; VII, fig. 10, 10a, 10b.)

HAB. Hawaii generally; now common in the cane-fields. This is the species referred to me in my Bulletin "The leaf-hopper of the sugar cane" as occurring at Olaa. It has also been found on Oahu by Mr. Swezey, but has not been taken in the cane-fields of this island.

28. *P. oahuensis*, sp. nov.

This appears to me to agree in nearly all important structures with the preceding, as well as in superficial appearance with certain of its varieties. In *P. oahuensis* the tarsi are dark in both sexes, the tibiae yellow and unbanded, the third antennal joint is yellow, or at least pale, in both sexes, but usually sordidly so in the male. The wings in the latter sex are quite smoky, in the female clear. The dilatation of the posterior tibiae outwardly bears some specially long black bristles, which differ from the general clothing of the legs, and this fact readily separates the species from the preceding. The ovipositor is very short and strong. Length 3.75-4.5 mm.

HAB. Mountains of Oahu.

29. *P. terryi*, sp. nov.

Front and face covered with white or whitish tomentum; third joint of antennae yellow or ferruginous, acuminate.

Thorax with very distinct, and not very sparse, clothing of fuscous or brown tomentum, pleura and metanotum with grey; marginal series of black bristles on the scutellum quite well developed; halteres dark at base, and sometimes also infuscate apically. Wings in the male rather lightly infuscate, clear in the female, the stigma shorter than the long fourth costal segment, small cross-vein nearly opposite termination of auxiliary, and considerably before the middle of the discal cell; posterior cross-vein very oblique. Legs with the coxae dark, the trochanters, base of femora widely and the apex more narrowly, the whole of the tibiae and sometimes nearly the whole of the tarsi, yellow, but the latter sometimes dark or obscured above; posterior femora banded with black or fuscous on the apical half.

Abdomen in the male black and shining towards the apex, fuscous-blackish on the second and following segments; in some aspects nearly entirely shining and slightly aeneous, clothed with quite distinct, but sparse hairs; basal segment banded with grey tomentum, the black lateral bristles well developed. Abdomen of the female with the surface densely covered with fuscous tomentum, sometimes paler along the apical margins of the segments, as also on the basal one, and quite conspicuously pilose; ovipositor straight, pale, of moderate length and thickness. Length 2.75-4 mm.

HAB. Kauai in the cane fields; but only found by Mr. F. W. Terry in one locality. It is closely allied to *P. juvator*, but most decidedly a distinct species.

30. *P. swezeyi*, sp. nov.

Male; front and face with whitish tomentum; third joint of the antennae acuminate and produced at apex, yellow.

Thorax somewhat shining, sparsely clothed with fuscous tomentum, the pleura and metanotum with grey; scutellum with longish marginal series of bristles; halteres pale, more or less infuscate at base and apex; wings smoky, stigma brown and about as long as the fourth costal segment; small cross-vein nearly opposite (a little beyond) the termination of the auxiliary; posterior cross-vein very oblique, its upper extremity about opposite the termination of the second longitudinal; legs with the coxae and apical joint of the tarsi black, all the rest clear yellow, the small spines beneath the femora, the hairs on these and on the tibiae and tarsi, black.

Abdomen nigroaeneous, and rather shining, with sparse and short, dark hairs; basal segment with the lateral bristles well developed, and more or less evidence of a grey apical tomentose band, possibly partly worn off in the specimen described; genitalia yellowish apically. Length 4 mm.

HAB. Oahu, Honolulu; a specimen taken in the mountains by Mr. O. H. Swezey. It is a most distinct species, possibly parasitic on the common little green Delphacid that frequents the *Freycinetia*.

31. *P. hawaiiensis*, sp. nov.

Very closely allied to *P. swezeyi*, from which it differs as follows: the basal joints of the antennae are ferruginous, as seen laterally, not dark brown or piceous; the mesonotum is very distinctly covered with greyish tomentum at the sides in front as also is the scutellum; the small cross-vein is rather nearer the base of the discal cell, and the wings are of a more yellow tint. Abdomen fuscous, and distinctly aeneous, the basal segment and sides of the others with grey tomentum, the surface hardly shining, except towards the apex of the body. Legs as in the preceding, but the posterior tibiae with two or three specially developed bristles on the median dilatation outwardly. Length 4 mm.

HAB. Hawaii; one specimen taken some years ago in a gulch in the Hamakua district.

32. *P. molokaiensis* Grimsh.

P. molokaiensis Grimshaw, Fauna Hawaiiensis Vol. III, Pt. 1, p. 17.

HAB. Molokai; it was common in the forest in 1893 but I only took two or three specimens.

33. *P. nigrotarsatus* Grimsh.

P. nigrotarsatus Grimshaw, loc. cit. p. 18.

HAB. Kona, Hawaii, 4000 feet. I have some suspicion that this may be identical with *P. juvator* described above, but none of the specimens of the latter seem to quite agree with it.

34. *P. rotundipennis* Grimsh.

P. rotundipennis Grimshaw, loc. cit. supra.

HAB. Kilauea, Hawaii, 1896.

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DESCRIPTION OF PLATES.

Plate V.

1. *P. cruciator*, female.
2. *P. cinerascens*, antenna viewed from the side outwardly.
3. *P. beneficiens* do
4. *P. eucalypti* do
5. *P. microdes* do
6. *P. cruciator* do
7. *P. hylaeus* do
8. *P. xanthocnemis* do
9. *P. anthracias* do
10. *P. heterostigmus* do

Plate VI.

1. *P. juvator* wing
2. *P. lamellifer* do
3. *P. beneficiens* do
4. *P. synadelphus* do
5. *P. nyctias* do

Plate VII.

1. *Hecalus* sp. containing larva of *P. cruciator*.
2. do after escape of the full grown larva.
3. Common type of *Pipunculus* puparium.
4. Puparium of *P. cinerascens*.
5. Puparium of *P. Koebelei* after emergence of fly; 5a the segment bearing the dorsal stigmatic processes or "horns;" 5b one of the processes more highly magnified.
6. Puparium of *P. cruciator* the horn-bearing segment removed showing the "horns" attached to the empty pupal skin.
7. Posterior stigmatic area of *P. cruciator*.
8. do *P. hylaeus*.
9. do *P. cinerascens*.
10. Larva of *P. juvator*; 10a posterior stigmatic area of the same in dorsal aspect; 10b the same in apical view.

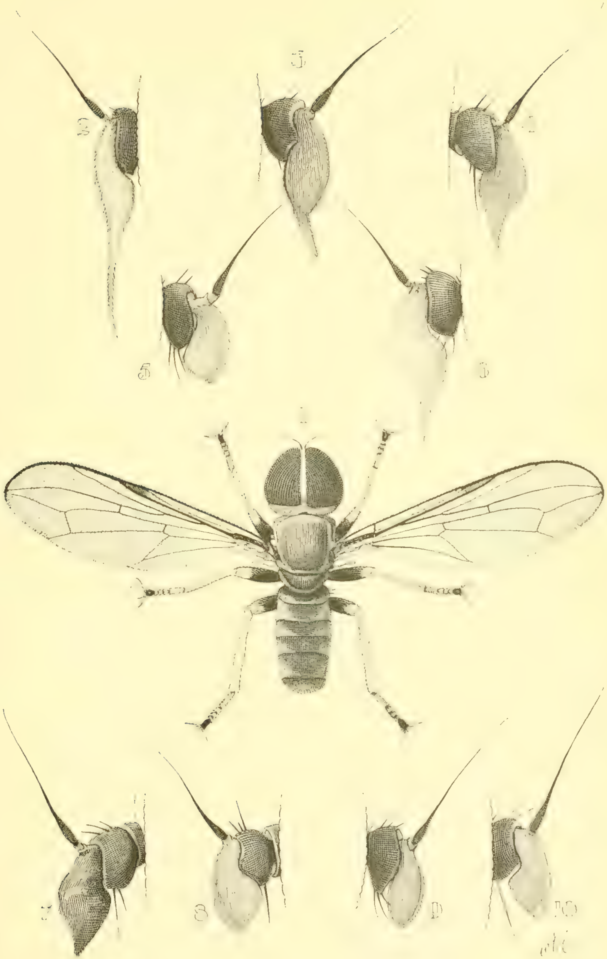
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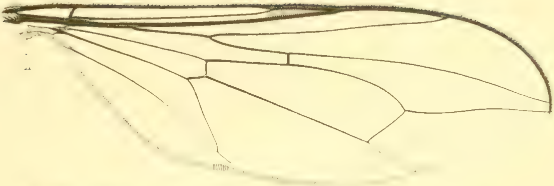
PLATE V.



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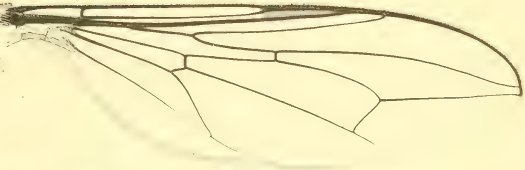

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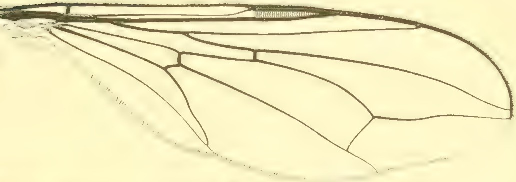

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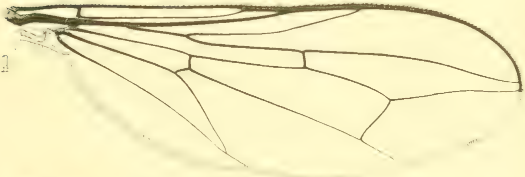

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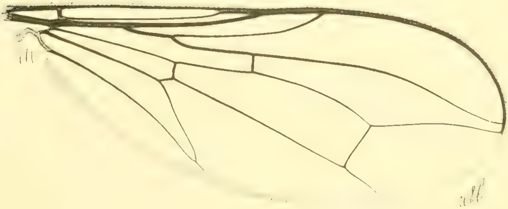

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PLATE VI.

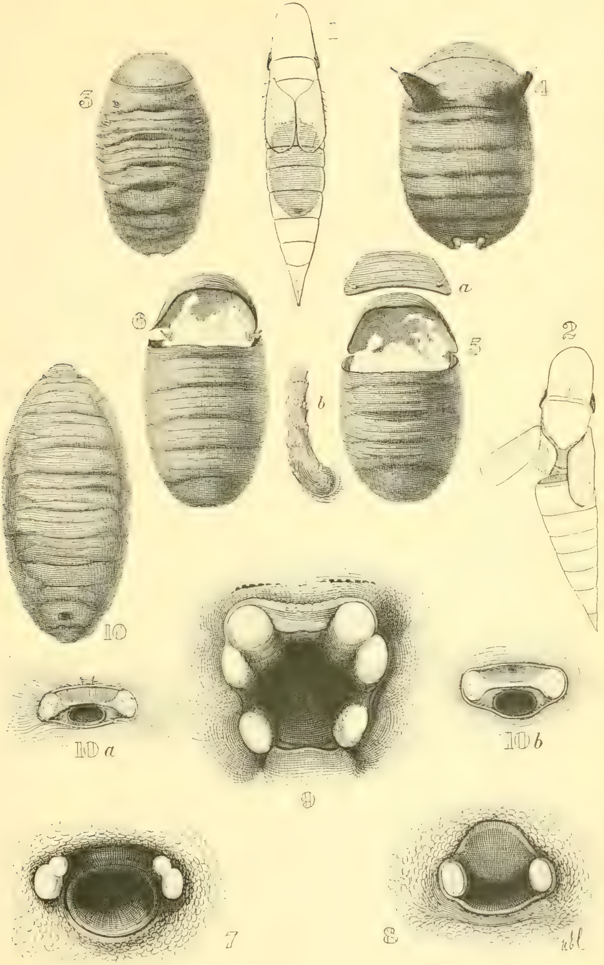
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PLATE VII.

DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 5

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(*PT. V. FORFICULIDAE, SYRPHIDAE, AND HEMEROBIIDAE*)

BY F. W. TERRY

HONOLULU, H. T.
NOVEMBER 13, 1905

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LETTER OF TRANSMITTAL.

Honolulu, T. H., October 23, 1905.

To the Committee on Experiment Station, H. S. P. A., Honolulu, T. H.

Gentlemen:—I, herewith,. submit for publication the fifth part of the Bulletin on "Leaf-Hoppers and Their Natural Enemies."

This part has been prepared by Mr. F. W. Terry, Assistant Entomologist of this Division ,and deals with some of the predaceous enemies of leaf-hoppers.

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

GENERAL REMARKS ON EARWIGS.

The Forficulidae or Earwigs are as a group very easily distinguished from any other families of the Orthoptera, but much diversity of opinion appears to exist as to their true affinities. Many authors still consider them a distinct order, Dermaptera or Euplexoptera; but the most general acceptation appears to be that they are merely a somewhat aberrant family of the Orthoptera. Their distribution throughout the world is very general, some species having a very wide range, owing no doubt to their secretive habits and facility of transportation. The warmer regions of the globe appear to be much more productive of species than the temperate zones. The total number of species recorded appears to be slightly over 500, these being included in 52 genera. Although practically omnivorous, the vegetarian habits of some of the Forficulidae are well known, and owing to the predilection of the common European species (*Forficula auricularia*) for the foliage of Dahlias and other favorite garden plants, this insect is very unpopular with the careful horticulturist.

Instances of damages to so important a crop as hops, are also recorded, but such cases appear to be rare. Several observations on their insectivorous diet are also recorded, the forceps being used to hold the unfortunate victim, whilst it is devoured at leisure. The economic value of *F. auricularia* in destroying the larvae and pupae of the Tortricid moth, *Cochylis ambiguella* (so destructive to grape vines in Europe) has also been observed, and also the destruction of other injurious insects. In New South Wales and Queensland, a small earwig, *Spongiphora* sp. (?) was observed in great numbers in the cane-fields, feeding upon leaf-hoppers and other insects, by Messrs. Perkins and Koebele. The maternal solicitude exhibited by the female for her eggs and newly hatched young has been recorded by numerous observers. Much diversity of opinion has been expressed by observers as to the use of the forceps; they have been observed to aid in the folding and unfolding of the wings, and in the raising of the tegmina preparatory to flight. From personal observation we know that they are important aids to feeding, defense, aggression, and titillation on the part of the male preparatory to copulation. One S. American species (*Sphingolabis linearis*) is stated to cause much annoyance and painful wounds with its forceps, "leaving double puncture marks on the skin."

But few parasites have been observed or recorded; Lucas obtained a yellow parasitic worm, which he suggests is a Nemathelminthid (*Mermis* sp.), from a specimen of *Forficula auricularia*, the abdomen of which was much swollen. Two Tachinids are recorded; Rodzianko stating that *Roeselia antiqua* was bred from an East European species, *Forficula tomis*, and Fischer records another fly, *Tachina setipennis* from *Forficula* sp.

Of the eight species known to be established on these islands, the five following have been observed in the cane fields:

1. *Anisolabis annulipes*, Lucas. Common generally.
2. *Labia pygidiata*, Dube. Common locally.
3. *Labia sp.* Not common.
4. *Labidura sp.* Not common.
5. *Chelisoches morio*, Fab. Common in the wet districts.

Of these *Chelisoches morio* and *Anisolabis annulipes* are of considerable economic inportance and have therefore been particularly studied.

CHELISOCHES MORIO.

(1) General Remarks.

Of the species in these islands, this fine Forficulid is certainly the most important economically. It has a wide distribution in the islands of the Pacific Ocean, and is recorded from Tahiti, Fiji, Hawaii, New Guinea, Java, Sumatra, Celebes, Philippines, Batchian, India and Ceylon.

It is an extremely active species, especially during the larval period, and appears to be diurnal, running over the leaves in search of insect food during the hottest part of the day. The adults will readily take to flight, the unfolding of the wings being a very rapid process and quite independent of the forceps, the writer never having seen them used either to assist in the folding or unfolding process. Wet localities seem to suit it best, since it abounds in the moist mountain ridges and valleys, and also in many of the elevated and wetter plantations. It is scarce in the dry and irrigated cane areas. Its predatory habits on leaf-hopper have been observed by several people. Young hoppers are seized and devoured without the aid of the forceps, but these organs frequently assist in holding an adult hopper whilst it is eaten at leisure. An examination of numerous crops invariably revealed only insect remains, often entirely leaf-hopper. Those bred in captivity showed during all instars a marked preference for insect diet.

(2) The abdominal plates.

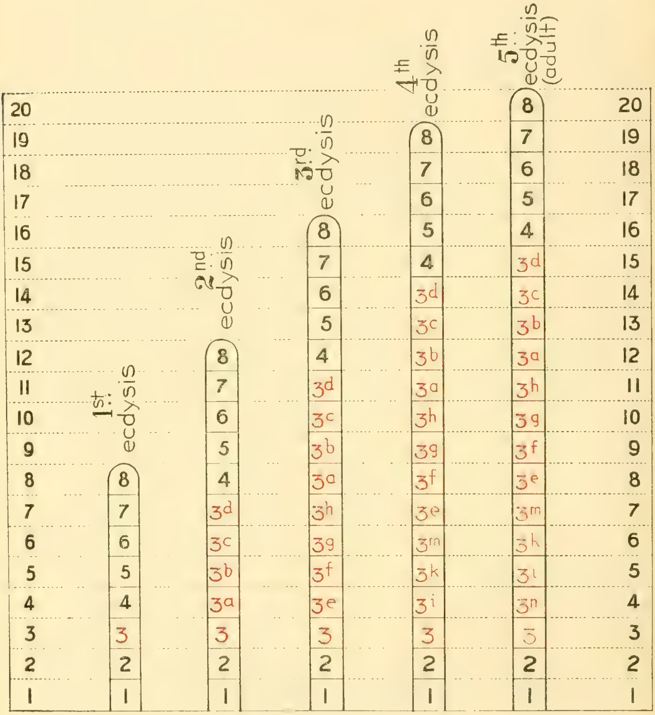
The much-discussed fused dorsal, and missing ventral abdominal plates, are well represented in the female of this species The (presumably) 8th and 9th tergites are very narrow (still more so in *Anisolabis annulipes*) and fused on to the large 10th. The (presumably) 8th and 9th sternites are much reduced; the 8th is almost entirely membranous except for the anterior chitinized angles; the 9th still remains chitinized laterally, these areas forming thin laminae; the 10th consists of a pair of strongly chitinized plates, each with an inner articulation to permit defaecation. In *Anisolabis annulipes* these ventral plates (except the 10th) appear to have entirely disappeared (Pl. IX, fig. 5.)

In the male *Chelisoches*, only the 10th sternite is discernable, represented by a pair of strongly chitinized plates. There appears to be no trace of the 8th and 9th sternites the whole membranous area being extremely delicate. The 8th and 9th tergites are normally developed and not fused. Pl. IX, fig. 6.

There is still one sternite to be accounted for in both sexes (presumably the 1st). No trace of its early fusion with the metasternum could be found.

(3) The development of the antennal joints.

The increase of the antennal joints at each instar appears to be perfectly constant, since large numbers in all stages were examined. The additions at each ecdysis arise from the segmentation of joint 3. Upon hatching the antenna consists of eight joints; at the first ecdysis this number is increased to twelve, the additional four arising from joint 3, thus the 4th joint becomes the 8th. At the second ecdysis the additional four again arise from joint 3, the previous four being thus pushed forward, the original 4th joint now becomes the 12th. At the third ecdysis only three additional joints are gained, and at the fourth (last) only one, so that the original 4th now becomes the 16th.



	1st. ecdysis	2nd. ecdysis	3rd. ecdysis	4th ecdysis	5th. ecdysis (adult)	
20					8	20
19				8	7	19
18				7	6	18
17				6	5	17
16			8	5	4	16
15			7	4	3^{d}	15
14			6	3^{d}	3^{c}	14
13			5	3^{c}	3^{b}	13
12		8	4	3^{b}	3^{a}	12
11		7	3^{d}	3^{a}	3^{h}	11
10		6	3^{c}	3^{h}	3^{g}	10
9		5	3^{b}	3^{g}	3^{f}	9
8	8	4	3^{a}	3^{f}	3^{e}	8
7	7	3^{d}	3^{h}	3^{e}	3^{m}	7
6	6	3^{c}	3^{g}	3^{m}	3^{k}	6
5	5	3^{b}	3^{f}	3^{k}	3^{l}	5
4	4	3^{a}	3^{e}	3^{i}	3^{n}	4
3	3	3	3	3	3	3
2	2	2	2	2	2	2
1	1	1	1	1	1	1

It is possible that the adult insect sometimes possesses more than twenty joints, but that appears to be the maximum, out of a large series that were examined.

(4) Description of all stages from egg to adult.

The Egg.

The eggs are deposited in a heap usually in the leaf sheaths of various large-leaved succulent plants such as *Canna* and sugar-cane, and are placed sufficiently far down to afford ample protection from the sun or enemies, the mother keeping continuous guard during the incubation period and for several days after the hatching of the young. She is most assiduous in her attentions to her ova, removing them carefully with the mandibles and palpi and constantly rearranging the batch. This maternal solicitude has been frequently observed in various species of earwigs and other insects; not infrequently however if disturbed, she will devour the entire lot. These batches consist of from about 40 to 60 eggs, the average number being about 45. Upon deposition, they are of an ivory whiteness and broadly oval, measuring about 1 mm. x 0.75 mm. (Pl. VIII, fig. 1.) As development proceeds and the surrounding moisture is absorbed, the elastic egg-membrane allows a very considerable increase in size to occur during the next few days. So that on the 5th or 6th day, (i. e.,) just previous to hatching) they are fully twice their original bulk, measuring 1.50 mm. x 1 mm. At this stage the embryo can be distinctly discerned in ovo, the abdomen being curved forward so that the forceps lie against the ventral surface. (Pl. VIII, fig. 2.) No trace of segmentation in the forceps of the embryo can be detected in this species.

First Larval Instar.

The larvae emerge about the 6th day and are at first of a pale ivory white; pigmentation rapidly develops, the eyes, head, apical antennal joints and femora assume a pale bluish grey coloration, which rapidly darkens and extends over those portions of the body surface which are destined to become black. At this instar the dimensions are as follows:

Antennae 2.50 mm.
Head and body 3-3.50 mm.
Forceps 1 mm.

The general facies even at the 1st instar is remarkably like that of the adult—this is still more apparent in *Anisolabis*—the chief difference apart from the absence of tegmina and wings,

being the relatively larger head, smaller forceps and the reduced antennal segmentation; head broadly cordate, dark brown, eyes black, antennae with eight joints, sparsely covered with short stout hairs, and 2nd joint short, one-fourth the length of the 3rd, which is the longest, 4th to 8th about equal, terminal joint conical, brown, the basal joints yellow, gradually darkening, the apical dark brown. Pronotum subquadrate, narrower than head, angles rounded, testaceous, posterior margin being slightly emarginate. Mesonotum quadrate, equal in width and length to the pronotum, angles rounded, testaceous, with a median pale infuscate transverse band which extends to the episterna. Metanotum posteriorly slightly wider than the preceeding and shorter, distinctly emarginate, yellowish brown. Abdomen, campodeiform, dorsal segments ten, the 1st visible; ventral segments eight, no trace of 9th and 10th visible, testaceous, the sides with dark brown bands, widening and darkening antero-posteriorly and uniting at about the 7th segment. Forceps slender, nearly straight, no trace of segmentation, bases testaceous, reddening apically ,with stout hairs sparsely distributed. Legs stout, testaceous, basal halves of the femora smoky brown, tarsus 3-jointed, second joint very short with a distinct lobe which is about one-third the length of the 3rd joint.
Plate VIII fig. 3.

Second Larval Instar.

At about the 6th day (after hatching) the 1st ecdysis occurs. The dimensions at this instar are as follows:

Antennae 4 mm.
Head and body 5-6 mm.
Forceps 1.25 mm.

The general facies is very similar to that of the previous instar; the chief change being seen in the additional joints of the antennae. The following variations from the previous instar are to be observed: As regards the darkened areas, these are much darker. Head blackish brown. Antennae with twelve joints the additional four arising between the 3rd and 4th joints from the segmentation of joint 3; the basal even testaceous; the newly formed 4th to 7th shorter than those succeeding them; 8th and 9th dark brown, 10th (sometimes 9th or none) whitish; 11th and 12th very dark brown, terminal conical. Pronotum quadrate, as wide as head, yellow testaceous. Mesonotum, blackish brown, except the posterior margin, which is testaceous. Metanotum, more emarginate, testaceous with lateral infuscation. Abdomen, 1st segment testaceous, the rest uniformly blackish brown, ten segments dorsally, only eight visible ventrally. Forceps, more curved apically, a few rudimentary teeth present along the basal inner edge, castaneous. Legs, basal halves of the femora blackish brown; lobe of the 2nd tarsal joint similar to the previous instar. (Plate VIII fig. 4.)

Third Larval Instar.

At about the 17th day the 2nd ecydsis occurs. The dimensions at this instar are as follows:

Antennae 6 mm.
Head and body 7-8 mm.
Forceps 2 mm.

The general facies still resembles that of the very young larva. The dark brown areas of the previous instar have now become black, or nearly so.

The following changes are to be observed: Head black. Antennae with sixteen joints, the additional four arising between the 3rd and 4th joints, again being produced from segment 3; the basal three testaceous, the newly formed 4th to 7th joints shorter than those succeeding them, (thus resembling their predecessors in the previous instar,) dark testaceous, the rest black except usually the 12th and 13th (sometimes only one of these), whitish. Pronotum black. Mesonotum black, slightly wider than the pronotum. Metanotum, rather wider posteriorly than the mesonotum, black, except along the posterior emargination, which is whitish testaceous. Abdomen,—first dorsal segment partially hidden by the rudimentary wing lobes, darkly infuscate, the rest black. Forceps, dark castaneous, several minute teeth present along the basal inner edge, the curvature similar to that of the previous instar. Legs,—basal halves of the femora blackish, the apical halves and the tibiae, infuscate; lobe of the 2nd tarsal joint about half the length of the third joint. (Plate VIII fig. 5.)

Fourth Larval Instar.

At about the 30th day the 3rd ecdysis occurs: The dimensions at this instar are:

Antennae 10 mm.
Head and body 12-13 mm.
Forceps, 4-4.25 mm.

The general facies now more closely resembles that of the adult.

The following are the principal variations from the previous instar:

Head, intense black. Antennae with nineteen joints, the additional three have again arisen from segment 3, but this is not so apparent as in the earlier instars, owing to the excessive pigmentation; the shorter form of the extra ones however, is still traceable. The entire antenna black, except usually the 14th and 15th joints, whitish, but this colour is extremely variable at this stage ranging from the 12th to the 16th joint. The antennae often vary in this respect in the same individual and not infrequently the white only occurs on a portion of a joint. Pronotum quadrate, anterior angles square, the posterior rounded, intense black, posterior margin whitish. Mesonotum intense black, distinctly wider than pronotum, the undeveloped tegmina distinctly visible beneath the metanotal plates. Metanotum somewhat broader than mesonotum, posterior edge deeply emarginate, caused by the immature wings which are now distinctly visible beneath, forming a pair of well-developed metanotal plates. Metanotum, intense black, except for a whitish semilunar area on the inner margin of each lobe. Abdomen, ten dorsal segments, the 1st entirely hidden by the metanotal plates, (this segment has already become somewhat dechitinized,) the rest black; the 2nd segment is also partially covered by the metanotal plates. Forceps, similar in form to the previous instar, several minute teeth present along the inner margins, black. Legs,—femora relatively longer than in the previous instar, basal halves black, apical halves and tibiae darkly infuscate, tarsi testaceous, lobe of 2nd tarsal joint more than half the length of the 3rd joint. (Plate VIII, fig. 6.)

The Adult.

The last ecdysis occurs at about the 50th day and some 4 days elapse before the final black coloration is attained.

The adults vary very considerably in size; the following being the range of dimensions observed:

	Males.	females.
Antennae	11 mm.	11 mm.
Head and body	12-17 mm.	13-18 mm.
Forceps	4-7.25 mm.	4-7 mm.

Besides the very considerable increase in size, a very decided change is visible structurally, the tegmina have become much longer and are freely articulate at their bases; beneath them are the true flight-wings which are large and membranous. The forceps have also assumed a relatively greater development.

Head shining black; antennae with at least twenty joints, black, except usually the 13th and 14th joints ,which are whitish or pale testaceous (the distribution of these pale joints is extremely variable even on the same individual); the three basal segments semi-glabrous, the rest pubescent, the basal considerably the largest and much thickened, the 2nd very short, the 3rd-5th shortish, the rest increasingly longer and slender. Pronotum broader than head, shining black, anterior margin straight, angulate; the posterior margin rounded. Tegmina long, shining black, sometimes with an aeneous reflection, in the male reaching nearly to 2nd abdominal segment, in the female somewhat shorter. Wings large, when folded in the male reaching nearly to the 3rd abdominal segment; in the female somewhat less.

Abdomen flattened, finely granulated, shining black, sometimes with an aeneous reflection; in the male ten dorsal segments, the posterior segment large, hind margin straight, tuberculated and folded, impressed in the middle, eight visible ventrally; in the female ten dorsal segments (8th and 9th very narrow and fused to the 10th), the posterior segment large, (less square than that of the male), posterior margin straight, tuberculated and folded, impressed in the middle; six segments visible ventrally, (the hidden 7th and 8th membranous. Folds of scent-glands on 4th segment distinct. Forceps long, flattened, in the male larger and more strongly incurved than those of the female, the inner margin irregularly crenulate, with a jagged dilation and a prominent bifid tooth basally. (Another form occurs on these islands in which the basal dilation is reduced, and distinct teeth extend two-thirds of the entire length; in the female the incurvature is less pronounced, the inner margin is crenulate and devoid of teeth. Pygidium more prominent in female than male. Legs, black, stout, tarsi yellowish, lobe of 2nd tarsal joint nearly two-thirds the length of the 3rd joint. (Plate IX fig. 1 and 2.)

ANISOLABIS ANNULIPES ,Luc. (Pl. IX fig. 3.)

This inconspicuous earwig has a wide distribution both in tropical and temperate zones.

Like the more conspicuous *Chelisoches morio,* it is omnivorous, but prefers insect food, often feeding almost exclusively on the cane leaf-hopper, as an examination of several crops has proved. It is nocturnal, remaining hidden down in the leaf sheaths or under trash and stones where the female may often be found zealously guarding her eggs. This species is interesting structurally since it is one of the most completely apterous forms of the family.

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HEMĒROBIIDAE.

(*Chrysopinae.*)

The predaceous habits of the peculiar larvae of the Lace-wing flies are familiar to many. They feed chiefly upon Aphidae (plant-lice,) but various other injurious insects fall a prey to their voracity. The soft-bodied larvae of many species amply protect themselves by carrying various material and the general debris of their victims upon their backs, the dried skins, etc., of the latter being carefully packed between and upon the stout curved bristles of the lace-wing larva. The bodies of these larvae are usually much distended at about their middle, becoming rapidly attenuated posteriorly. The head is broad and depressed; the mandibles long and sickle-shaped. There is no true mouth, the fluids of the victims being sucked up through a groove which extends along each mandible.

The following four species of lace-wings have been observed in the cane-fields, feeding upon Aphidae and young leaf-hoppers. The first three are native species. The larvae of *Anomalochrysa* are often brilliantly colored, for example green with pink or crimson markings, and do not carry foreign matter upon their backs. The most beneficial and generally distributed species is *Chrysopa microphya*, a more detailed account of which is given below.

Anomalochrysa deceptor, Perk.

HAB. Oahu, Maui and Hawaii, but so far only found in the cane-fields on the latter island.

Anomalochrysa raphidioides, Perk.

HAB. Hawaii, found in the cane fields of that island.

Anomaiochrysa gayi? Perk.

HAB. Hawaii, found in the cane-fields of that island .

Chrysopa microphya, McLachl.

HAB. All the islands and in all cane-fields.

GENERAL REMARKS ON *CHRYSOPA MICROPHYA*, McLachl.

This small lace-wing fly is probably an introduced species but has undoubtedly been established on these islands for many years.

The stalked eggs are usually laid upon the under surface of a leaf or upon a branch, generally singly, sometimes in groups of 3 or 4. The larva upon hatching remains for a short time resting upon the empty egg. As soon as it leaves the egg-stalk it seeks eagerly for small particles of dirt, exuviae, etc, to place upon its back; should an Aphis or young hopper be encountered during the search, it is seized and after being sucked dry, the empty skin is placed upon the young larva's back. Those bred in captivity became full-fed in about 15 days, the adults emerging about 10 days later. The larvae are most voracious feeders and besides attacking young cane-leaf-hoppers have been observed to thrust their long mandibles into the imbedded hopper-eggs and suck them.

The oviposition has been described as follows: the female having selected a suitable locality, presses the tip of the protruded abdomen upon the leaf surface and exudes a viscid fluid (probably of a similar nature to silk) and then raises the abdomen, drawing out the viscous deposit into a thread, still attached to the abdomen; having proceeded thus, the egg is then extruded and attached to the extremity of this thread or egg-stalk.

The egg is oval, length about .75 mm., bright green, becoming yellowish as development proceeds; it is borne upon an extremely delicate hair-like stalk, 4-5 mm. in length.

The adult larva is about 5 mm. long. Head, across the eyes broader than long, depressed, pale greenish-testaceous, with four pairs of blackish longitudinal bands, the median pair one-third the length of the head, starting from the inner bases of the mandibles, convergent posteriorly; the extra-median pair broader, and extending from the mandibular bases to the back of the head, convergent posteriorly; the lateral pair narrow, and extending from the back of the eyes to the back of the head, the extra-lateral pair short and extending posteriorly from the sides of the eyes, this band is divided just behind the eyes, uniting shortly after. Eyes prominent, black. Mandibles, sickle-shaped, longer than the head, widely remote at their bases, testaceous, ferruginous apically.

The thoracic segments distinct from abdominal. Prothorax, broader than the head ,widening anteroposteriorly, bearing anterolaterally a pair of tubercles with radiating recurved bristles. Mesothorax, much broader than prothorax, the narrow constricted portion in front appearing to belong to the former, width more than twice the length, bearing antero-laterally a pair of tubercles bearing radiating recurved bristles. Metathorax, broader than the mesothorax. Width more than three times that of the length, bearing laterally a pair of tubercles with radiating recurved bristles. Legs moderate, whitish-testaceous.

Abdomen napiform, seven-segmented, each segment with a pair of lateral tubercles bearing bristles.

The general body coloring is pale greenish-testaceous with paired and irregular mottling of brown, the thoracic tubercles are whitish-testaceous and much larger than those of the abdomen, the latter being of the general body coloring, pale greenish-testaceous.

Pupa case nearly globular, about 2 mm. long, formed of closely-spun whitish silk, and usually covered with insect remains, etc.

Unfortunately the pupa of this beneficial insect is attacked by an Ichneumonid parasite, which at certain times and places becomes quite numerous.

The adult Lace-wing has been described by McLachlan as follows:

"*Chrysopa microphya,* n. sp."

"Body yellowish testaceous ("bright green" in life.) Head polished; palpi, antennae, and legs concolorous with the body; basal joint of antennae strongly bulbose; claws dilated internally at the base.

Abdomen apparently having a blackish band on either side, in which are yellow (or greenish) spots; clothed with rather long, but not dense hairs.. In the male it is terminated by a broad oval superior plate, concave beneath, and ventrally by a much shorter nearly semicircular plate.

Wings vitreous, slightly iridescent, ovate, subobtuse; neuration strong, open; longitudinal nercures greenish, transverse and graduate nercules mostly blackish, the costal nercules pale at either end, the whole set with rather long black hairs; pterostigmatic region elongate (very long and somewhat dilated in posterior wings of male), greenish; subcosta becoming confluent with the costa before the apex; partition nervule of the third cubital cell extending beyond the nervule above it (the cellule oval); six and eight nervules in the two gradate series in the anterior wings of the male, and four and five (or six) in those of the female (in the pair before me;) fifteen to seventeen antepterostigmatic nervules.

Length of body 6 millim; expanse, male 20 millim., female 22 millim.

One of the smallest species and, in some respects, aberrant, the condition of the subcosta showing analogy with *Hypochrysa*, and the formation of the apex of the abdomen with *Anomalochrysa*; but as there are only two series of gradute nervules it cannot be located in the latter genus."

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SYRPHIDAE.

The economic value of the larvae of certain members of this Dipterous family are well known ,their aphidivorous habits making them of great benefit in destroying vast numbers of plant-lice. The larvae of one of the following species of *Baccha* were found in considerable numbers, feeding upon young leaf-hoppers in Queensland.

Baccha siphanticida, sp. nov.

Male: face retreating around epistoma, antennal prominence and frontal tubercle moderate but well defined, shining black, with whitish pubescence and greyish hairs on the sides of the frontal tubercle and epistoma; vertical triangle shining black; back of head whitish with greyish ciliation; antennae dull yellow, 3rd joint broadly oval, about as long as deep, arista bare, apically dark, pale at the base. Thorax and scutellum shining, aeneous, sparsely covered with short dark hairs and very finely punctate; scutellum fringed with brownish hairs, meso- and sternopleura with sparse testaceous pubescence and hairs, golden aeneous.

Abdomen, two and one half times the length of the thorax, the general facies spatulate, blackish brown, shining, destitute of marking, the specimen appearing somewhat immature. Second segment cylindrical and very slender; 3rd segment rather shorter and of the same width basally, but rapidly widening apically; 4th segment long, widest at its middle; 5th segment very short, narrowing considerably at its apex, hairs brownish, quite long, especially at the base. Legs testaceous, coxae and trochanters infuscate, the distal halves of the hind femora (except the knees) and tibiae infuscate. Wings hyaline, iridescent, subcostal cell infuscate, a faint transverse infuscation across the dividing point of the 2nd and 3rd longitudinal veins, and extending to the lower cross vein, also a faint transverse infuscation at the apices of the marginal and submarginal cells, with a central nonfuscate oval spot within this area. Alulae large, squamae pale yellow. Halteres yellow. Length 8.25 mm.; wing expanse 14.75 mm.

Female: face retreating as in male, steely, greyish hairs with whitish pubescence extending to sides of epistoma. Vertex steely, destitute of pubescence, with dark hairs. Frons with dark hairs and laterally a narrow band of whitish pubescence; antennal prominence and central tubercle destitute of pubescence; on the outside base of the antenna in one female, is a sub-semi-lunar purplish-violet area, the other specimen showing no trace of this; back of head more densely pubescent than in the male; antennae similar to male, 3rd joint rather less broadly ovate. Thorax and pleura blackish-aeneous or steely, scutellum aeneous fringed with grayish hairs, the mesonotum and scutellum finely punctate and clothed with short, whitish suberect hairs, with darker hairs on front of thorax. Meso-and sternopleura with dense whitish tomentum and hairs, mesopleura with a whitish yellow spot on its posterior margin. Abdomen; the general facies similar to that of the male but rather stouter, about three times as long as the thorax, black or steely and finely punctate, with numerous hairs distributed over the surface, these hairs are dark dorsally, whitish and more abundant laterally, and at the base are very long; at the base of the 4th segment are a pair of lateral sub-scalene-triangular, pale yellow patches, clothed with whitish hairs. Wings hyaline, with the following infuscation: The basal, costal and 2nd costal cells, the sub-costal cell (very dark), the basal half and apex of the marginal cell, the extreme base and apex of the sub-marginal cell, the middle of the upper basal cell, the bases and apical and middle of the middle and lower basal cells, the bases of the 2nd and 3rd posterior cells and the wing base. Alulae and squamae as in the male, halteres orange, legs similar to the male but owing to the greater maturity, brighter yellow, and the infuscation blackish. Length 11 :75; expanse 19 mm.

HAB. Queensland, Cairns and Kuranda, (Koebele 2250) The larvae were observed in abundance around Cairns by Messrs. Koebele and Perkins, and were found to be feeding upon larvae and nymphs of Poecilopterine Fulgorids of the genus *Siphanta.* Many of the puparia were observed to be parasitized by a Chalcid. On one occasion great numbers of the adults were seen in one locality, hovering at a considerable height above the ground.

The following is a brief description of the puparium: Pyriform bulbous anteriorly, attenuated posteriorly, coriaceous, at the posterior extremity a respiratory tube, about one-fifth of the length of the puparium ,with a very short apical bifurcation, upon which opens the paired stigmata. General coloration dirty brown and blackish, with pale ill-defined bands arising in pairs from the median dorsal area. Length, 5 mm. length of tube 1 mm. Respiratory tube testaceous.

Baccha monobia, sp. nov.

Male: This species closely resembles the preceeding; the chief difference being that of color. Antennal prominence more pronounced than in the male of *B. siphanticida*, with a similar, but more vivid purplish-violet patch than that of the female of that species; antennae, dark orange. Thorax and scutellum, purplish-aeneous, with golden reflection anteriorly, clothed with short brownish hairs, scutellum fringed with dark hairs; sides of pronotum, the meso-and sternopleuron golden aeneous, with orange pubescence and hairs, pteropleuron brilliant golden with purplish marginal reflection. Abdomen, three times the length of the thorax, purplish-black, without markings, with whitish hairs, very long on the sides at base. Wings infuscate, iridescent, with still darker infuscation distributed as in the female of *B. siphanticida*.. Alulae large. Legs, brownish, coxae and trochanters blackish, hind femora and tibiae darkly infuscate, knees paler. Length 9.50; expanse 17 mm.

HAB. Kuranda, Queensland; one male taken whilst hovering around a *Siphanta* colony.

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Larvae aphidophagous, provided with well-developed hooklets.
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Larvae feed on Aphidae or Coccidae.

DESCRIPTION OF PLATES.

Plate VIII.

1. Eggs of *Chelisoches morio.*
2. Embryo of the same in ovo.
3. Larva of the same 1st instar.
4. The same 2nd instar.
5. The same 3rd instar.
6. The same 4th instar.

Plate IX.

1. Adult female of *C. morio.*
2. Adult male of *C. morio.*
3. Adult female of *Anisolabis annulipes.*
4. Adult male forceps of the same.

5. Ventral surface of the distal portion of the abdomen of the female of *C. morio.* The large ventral plate (sternite 7) has been removed. *a*, cut edge of the 7th sternite; *b*; chitinized anterior angle of the 8th sternite; *c*, anus; *f*, articular portion of the 10th sternite; (the articulation allows the free passage of foecal matter; *g*, 10th sternite; *h*, 10th tergite; *i*, thinly chitinized plate of the 9th sternite; *k*, 9th tergite; *l*, 8th tergite; *m*, 7th abdominal stigma; *n*, genital aperture.

6. Ventral surface of the distal portion of the abdomen of a male of *C. morio.* The terminal ventral plate (sternite 9) has been removed.

a, penis (in situ); *b*, 10th tergite; *c*, 10th sternite; *d*, anus.

Plate. X.

1. Egg and newly hatched larva of *Chrysopa microphya*, McLachl.
2. Adult larva of the same.
3. Cocoon with the pupal skin of the same.
4. Adult female of the same.
5. *Baccha siphanticida*, (female.)
6. Puparium of the same.
7. Spiracular tube of the same, (much enlarged.)
8. Side view of the head of the same.

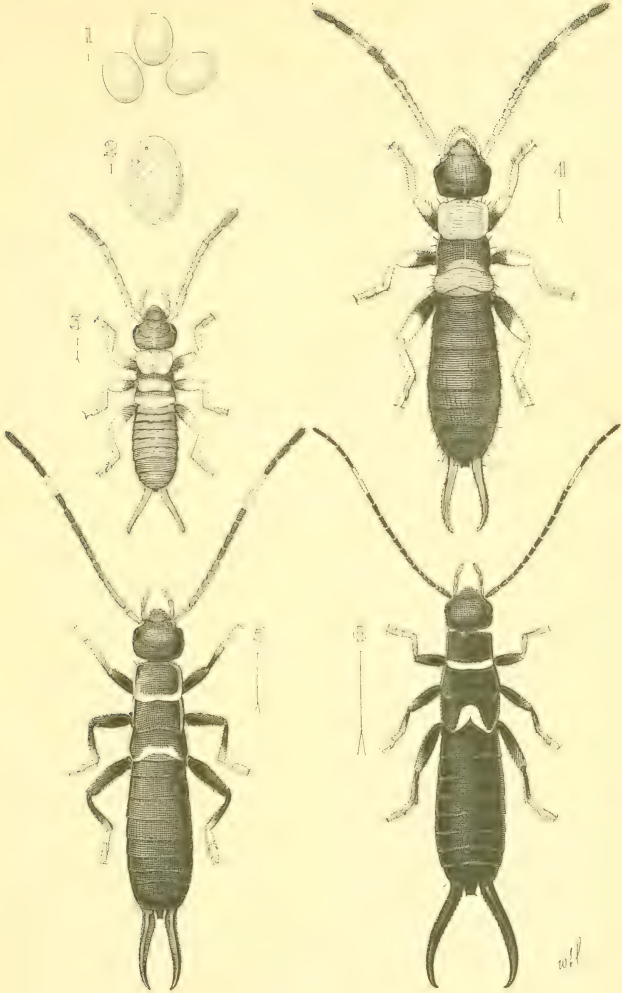
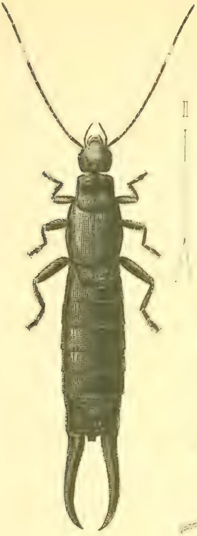
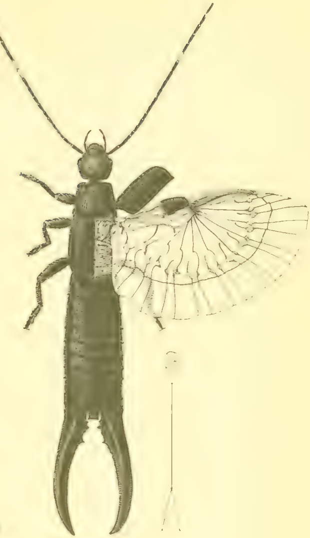
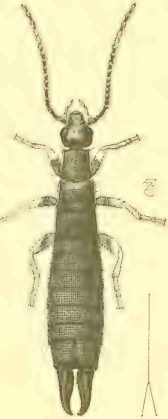
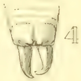


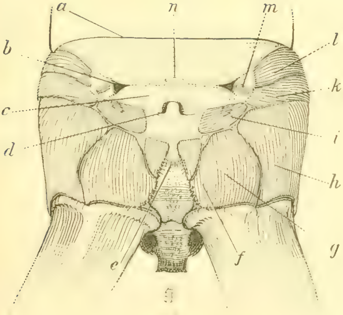
PLATE VIII.







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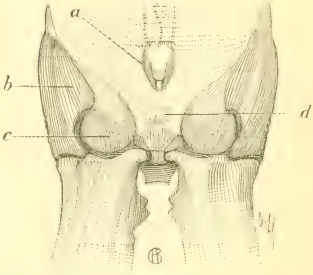

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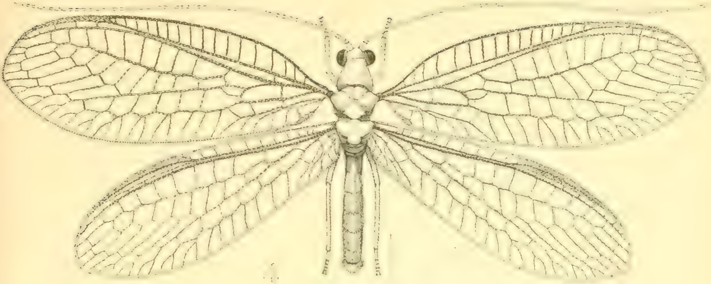
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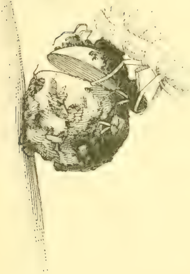
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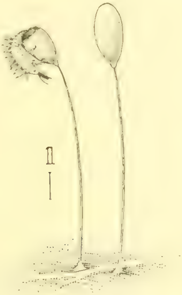
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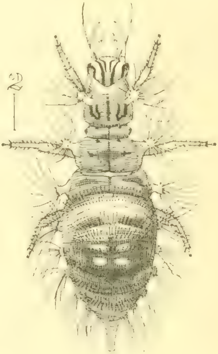
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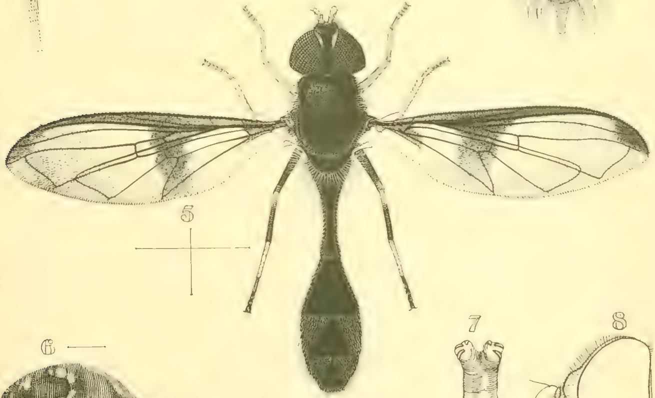
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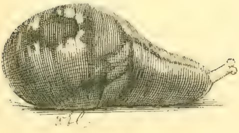
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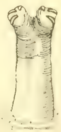
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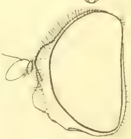
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PLATE X.

DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 6

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. VI. MYMARIDAE, PLATYGASTERIDAE)

BY R. C. L. PERKINS

HONOLULU, H. T.
NOVEMBER 13, 1905

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NOVEMBER, 1905

LETTER OF TRANSMITTAL.

Honolulu, T. H., October 23, 1905.

To the Committee on Experiment Station, H. S. P. A., Honolulu, T. H.

Gentlemen:—I, herewith, submit for publication the sixth part of the Bulletin on "Leaf-Hoppers and Their Natural Enemies," which deals with some of the parasites that destroy the eggs of leaf-hoppers.

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

INTRODUCTORY REMARKS ON THE MYMARIDAE

The Mymaridae are a family of excessively minute insects, and authorities are not agreed as to the position that it should occupy in the great groups of Hymenoptera. Almost all the known species are parasitic in the eggs of other insects. Those species with which I am personally acquainted always emerge singly from the egg that they have destroyed, but others are bred in some numbers from a single egg. Probably they attack the eggs of almost all orders of insects, as I have bred them from those of Lepidoptera, of Rhynchota, Homopterous and Hemipterous, and also of Neuroptera, and they likewise destroy those of Coleoptera. Some are recorded as having been bred from scale-insects and plant-lice. Of the species hitherto described, in comparatively few cases, are the hosts known, and it is safe to say that all the species hitherto collected by Entomologists do not amount to one in hundreds, that exist. Some of the larger species may be obtained in numbers with the sweeping net by anyone with good eyesight, and others are frequently seen in plenty running on glass windows, especially those of hot-houses in cold countries, as the English collectors observed three-quarters of a century ago. The majority of the species that exist, however, are not likely to be met with, except by breeding them, for many are so minute, that except by chance they cannot be collected in the field. Some species do not exceed one-third of a millimeter in length and others are said to be even smaller, while the pallid color of many of the minute species renders them almost invisible to the naked eye.

The long and very slender wings, fringed with long hairs, are one of the most striking characteristics of the family, and with these delicate organs of flight some even of the smallest species can fly better than might have been expected. Many of them have a frequent habit of rising slowly and vertically upwards on the wing, and as they cannot withstand a moderately strong current of air, this habit must lead to a much quicker and wider distribution of the species than could ever be attained by their own unaided powers of flight. The legs of most species are long and some of them, especially a species of *Alaptus* that I have studied, can run with astonishing rapidity.

Even though they be unacquainted with the Mymaridae themselves, most entomologists know that the family contains most of the very few parasitic Hymenoptera that are known to enter the water of their own accord. Some of these species swim by means of their wings, others of their legs, and they are parasitic in the eggs of insects that are wholly or partly aquatic, such as dragon-flies,* water-bugs and water-beetles.

During the past six months I have bred many thousands of several species of those Mymaridae, that are parasitic in the eggs of leaf-hoppers, in order to distribute them to the different sugar plantations troubled with the pest. Consequently I have had many opportunities of observing their habits, which while alike in most respects, yet differ somewhat in detail.

GENERAL ACCOUNT OF *PARANAGRUS OPTABILIS*.

Though not one of the smallest, since it measures about ¾ mm. this species is of very slender and delicate form, and has long fringes to both front and hind wings. It has that habit of rising slowly upwards on the wing, often with more or less spiral flight, that I have already alluded to. In captivity it is quite easily seen as it runs actively about on the leaves of the cane plants continually touching their surface with the tip of its antennae. On arriving at a fresh scar, marking the place where a leaf-hopper has laid its eggs, it thoroughly investigates this with the characteristic dilated club-joint of the antennae. After this investigation it sometimes passes on, but at others it proceeds to thrust the tip of the ovipositor into the egg chamber of the leaf-hopper, still keeping the tips of the antennae in touch with the surface. (Pl. XIII fig. 3.) Since the antennae are directed vertically (or nearly so) downwards, and are relatively of great length, in order to bring their tips in contact with the surface of the leaf the parasite is obliged to raise itself high on its two front pair of legs, and consequently assumes a characteristic position during oviposition. The ovipositor, when freed from its sheaths and in action, forms a strong angle with the lower surface of the abdomen, in some cases approaching a right angle. When the scar, that marks an egg-chamber, is after investigation passed by, though it is evidently recent,

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* In these remarks the genus *Prestwichia* is included, since it has generally been assigned to the Mymaridae (but erroneously) and its habits have been specially studied.

and the parasite almost immediately proceeds to investigate another, and to lay therein, it is probable that the eggs in the first one have been already parasitized, though of course it may be simply that the egg of the leaf-hopper has advanced beyond a proper stage of development for being parasitized. In eggs examined I found no advanced stage of development of the leaf-hopper embryo, when they contained a larva of the parasite. However this may be, a suitable egg-chamber having been found, the ovipositor is kept inserted for a considerable time, sometimes for several minutes. Both in the preliminary examination of the egg-chamber and during the process of oviposition, the parasite may sometimes be seen by a very rapid turn through half a complete revolution, to exactly reverse its position, and this sometimes takes place more than once. Chalcids of other families, with habits similar to the Mymarids, behave in precisely the same way, and are even more rapid in their movements, so that these can only be appreciated by our eyes owing to the change of position, the head and tail end of the parasite having as it were, changed places instantaneously. The number of eggs of leaf-hopper in a single chamber varies from one to twelve or more, six or eight being common, and all these eggs may be stung, or some may escape. I have not examined the egg of the parasite which presumably is thrust into the leaf-hopper's egg, and in that case is likely to be hardly or not at all visible amongst the opaque contents of the latter. The mature larva is the usual apodous grub, and it may be seen performing its curious rotatory movements amongst the fluid contents of the egg that contains it. It has also a habit at times of violently throwing forward its anterior segments, so that the head of a half grown larva, which reaches to the middle of the hopper's egg, will, at its greatest extension, nearly attain the operculum. According to authors in *Polynema*, there is a very remarkable second form or '*Histriobdella*' stage of the larva. I have not yet observed this in *Paranagrus*, but the third form (as figured by me) greatly resembles that of *Polynema*. The smallest larve examined by me measured $\frac{6}{16}$ mm., the largest $\frac{13}{16}$ mm. so that the main growth must be in this stage. Except in size the smallest and largest larvae did not noticeably differ.

The head of the larva has a quite remarkable armature as is represented under very high magnification on Pl. XIII, fig. 5 and 5a, from a half grown example extracted from the egg of its host. The pupa almost or quite fills this egg (excluding the opercular portion) and before it is fully developed is generally very easily distinguishable in form, by the pigmented, sometimes deep crimson-colored, granular contents, which mark out different areas. (Pl. XIII fig. 4.) Shortly before hatching, the pupa appears more uniformly yellow, owing to the color of the adult insect, shining through the thin, translucent pellicle. In about twenty days from oviposition the adult parasite emerges from the egg-chamber of the leaf-hopper.

In this and other species of *Paranagrus* the winged parasite escapes through the scar made by the leaf-hopper; but some species of *Anagrus*, parasitic on the same eggs, and very similar in general appearance to those of the above named genus, never do so, but always gnaw a distinct round hole, in order to leave the egg-chamber. Such too is the habit of *Polynema reduvioli*, which often emerges at quite a distance from the free extremity of the imbedded egg, in which it was bred. (Pl. XIII, fig. 7.)

The habits of the two egg-parasites that are commonly found together in the cane fields are also in some other respects strongly contrasted. The *Paranagrus* has a particular liking for the egg-chambers placed at the bases of the mid-ribs (where in fact they are most numerous) though it will attack those in any situation. The *Anagrus* on the other hand greatly prefers those on the higher parts of the mid-rib and more particularly on the edges of this, where the lamina of the leaf joins it. Very rarely does it attack the eggs at the base or in the centre of the mid-rib, unless in the case of very young cane leaves.

The species of *Anagrus* and *Paranagrus* here dealt with are habitually parthenogenetic, the males only appearing at intervals, and then in very small numbers, as compared with the females. In breeding a species of the latter genus continuously from January to September, a fresh brood appearing every three weeks, it was not until the middle of the latter month that the first males appeared. During the time specified very many thousands of individuals were examined, and the males, it should be added, can easily be distinguished from the females by anyone familiar with the species, without the aid of a lens. The case of the *Anagrus* is similar, as far as the species we have studied are concerned. One may in fact regard the species of these two genera as far advanced on the road towards perfect parthenogenesis.

CLASSIFICATION.

Haliday, who perhaps studied these atoms of insects more carefully than other hymenopterists, as early as 1833, assigned them to the Chalcidoid series, and Ashmead, the latest writer whose works I have used, agrees with him. On the other hand such famous entomologists as Westwood, Foerster and Thomson all agree in placing them in the Proctotrupoid family; and I believe that this great difference in opinion is a true indicaton of the anomalous character of the Mymaridae. While they cannot, judging from the forms that I have studied for the purposes of this paper, be possibly included amongst the Proctotrupoids, it must be admitted that, if they be referred to the Chalcidoid series ,they form an unusually distinct family in the latter. In fact they are probably more distinct from any family in this series, than is any other of its families, from that to which it is most nearly allied. Unfortunately in the literature accessible to me the structural characters of the genera are for the most part merely given in dichotomous tables, and therein characterized in such very brief fashion, that I cannot determine with certainty whether the species here described really belong to the genera, to which the tables assign them, or not. None of these tables make mention of characters, which I believe to be of great importance for purposes of generic division.

The family Mymaridae has been divided into two sub-families according to the number of the tarsal joints, and each of these is further divided into two 'tribes' according to the nature of the basal articulation of the abdomen. For purposes of identification of genera these divisions are convenient; as a natural classification their value appears to me very dubious. The variability in the number of tarsal joints in those families of the Chalcidoid series, which are most nearly allied to the Mymaridae, is known to all students of parasitic Hymenoptera to be of inferior value, this number in some cases differing even in the sexes of one species. It is quite probable that the nature of the articulation of the abdomen, and possibly the differences in the structure of the thorax, will prove of much greater importance than the number of tarsal joints.

To me, by far the most remarkable character in the Mymarids, that I have studied, is the extraordinary difference in the relation of the base of the abdomen to the posterior end of the thorax, even in species that resemble one another in their general habits. In the species that I describe under the genera *Anagrus*, *Paranagrus* and *Alaptus* the abdomen is truly sessile, adapted at the base to the thorax, the rigidity being further increased by the great thoracic mesophragma, which penetrates well back into the abdomen. Forms that I refer to *Ooctonus*, *Polynema* etc., on the other hand have a mobile, pedicellate abdomen and in these and petiolate forms, the very structure prohibits the presence of such a mesophragma in the abdominal segments. Yet in spite of these profound differences we find insects of the first class ovipositing in the eggs of leaf-hoppers laid in the leaves of cane or grass; those of the second doing precisely the same, as well as piercing the eggs of Heteroptera, imbedded in a similar manner in the cane leaf. It does not appear to me improbable that, when a special study is made of the peculiarities of the Mymaridae, and this study is based on a rich and well prepared collection, the group will prove to be of more than family rank and itself to contain some very distinct families.

The Mymaridae, or at least such as I have studied in connection with this paper, appear to me to be most nearly allied to certain of the Eulophidae. Some of the latter have to a large extent the same structure of the thorax as the Mymarids, and in this point amongst others the latter at once differ from any true Proctotrupids known to me. It is further a somewhat remarkable fact that various Mymarids of very different groups have a pattern and arrangment of markings identical with that of certain Eulophidae. The wings are of the most characteristic form, and are very different from those of the egg-parasites of the family *Trichogrammidae*, from which I exclude Ashmead's sub-family Oligositinae, believing it will be sooner or later associated with the Eulophidae in spite of the three-jointed tarsi. In the presence of a great mesophragma extending far into the abdomen, the sessile-bodied Mymarids agree with many Eulophids and Trichogrammids, indeed in some of the latter this structure is enormously developed and extends almost to the apex of the body.

Ashmead who has published the latest classification of the Chalcidoid families, and has probably spent more time on this study than anyone living and whose views are therefore worthy of the most careful consideration, gives as the leading characters to define the Mymaridae:

"Hind wings exceedingly narrow, linear, pedunculate at base; ovipositor issuing from beneath just anterior to tip of abdomen; antennae without a ring-joint, the scape rather small, short, compressed:"

All the species considered here agree with this definition in two particulars (1) the hind-wings are narrow and pedunculate, (2) the antennae have no ring-joint. In other respects the characters do not agree with any of my species. Thus the ovipositor issues from close to the base of the abdomen in all of these, and is in all respects similar to that of many species of Eulophidae or of other Chalcid families. ((See Pl. XIII fig. 3 and fig. 6.) Further the scape of the antennae is always slender and elongate, except in a very few males. I am theretore led to ask myself whether there are species of Mymaridae with the structure of the ovipositor as described by Foerster and Ashmead, and which would partly account for the fact that several of the greatest of entomologists placed the group in the Proctotrupids, with which in this respect they were thought to nearly (though not exactly) agree, and if so, whether the family is really a natural one. It is certainly remarkable that, whereas in other respects my species and genera fall readily into the subfamilies and tribes, that have been suggested, yet they do not agree in the structure of antennae nor in the ovipositor with the family characters.

An important character requiring further study is the structure of the mesonotum. In some species this appears to be formed much as in many *Eulophidae*, the axillae being produced forwards acutely into the parapsides. In others I can detect no marked forward extension of the axillar pieces. In all the species specially examined by me, this forward extension is correlated with a sessile abdomen and does not occur in the pedicellate and subpetiolate forms.

In conclusion the species which I have most particularly studied, viz: those here described under the genera *Anagrus*, *Paranagrus*, *Gonatocerus* and *Alaptus* appear to me to be most nearly allied to certain Eulophidae, though differing greatly from these in the structure of wings and antennae, and further, amongst themselves present differential characters of perhaps even family value.

LIST OF *MYMARIDAE* HERE DESCRIBED.

1. *Ooctonus australensis*, sp. nov.
2. *Polynema* (?) *reduvioli*, sp. nov.
3. *Gonatocerus cingulatus*, sp. nov.
4. *Alaptus immaturus*, sp. nov.
5. *Anagrus frequens*, sp. nov.
6. *Anagrus columbi*, sp. nov

   Paranagrus, gen. nov.
7. *Paranagrus optabilis*, sp. nov. et typ. gen.
8. *Paranagrus perforator*, sp. nov.

TABLE OF GENERA AND SPECIES HERE CONSIDERED.

1 (6) Abdomen sessile, with a wide thoracic mesophragma extending well into it; front wings very narrow, the apical cilia much longer than their width.

2 (3) Tarsi 5-jointed (antennae of male 10-jointed; of female 8-jointed) .... *Alaptus immaturus.*

3 (2) Tarsi 4-jointed (antennae of male 13, of female 9-jointed.)

4 (5) Third antennal joint elongate almost as long as the fourth .... *Paranagrus.*

Ovipositor only slightly exserted behind the body. .... *P. optabilis.*

Ovipositor exserted behind the body for a length equal to that of the 4 joints of the hind tarsi together. .... *P. perforator.*

5 (4) Third antennal joint very short, much shorter than fourth .... *Anagrus.*

Front wings with a distinct bare longitudinal line on lower half .... *A. frequens.*

Front wings more evenly hairy (Pl. XIII fig. 8 & 8a.) .... *A. columbi.*

6 (1) Abdomen pedicellate or subpetiolate, and without a mesophragma extending back into it; front wings with the apical fringe short, much shorter than the width of the wings.

7 (8) Tarsi 5-jointed; antennae of female 11-jointed.

Abdomen pedicellate .... *Ooctonus australensis.*

Abdomen not pedicellate .... *Gonatocerus cingulatus.*

8 (7) Tarsi 4-jointed, antennae of female 9-jointed.

Abdomen pedicellate .... *Polynema reduvioli.*

DESCRIPTION OF GENERA AND SPECIES.

In the following descriptions important structural characters are generally given under the generic names, owing to the fact that I do not feel sure that the species are always placed in the right genera, for reasons that I have already stated. The neuration does not differ greatly in these genera, being much as in the *Paranagrus* figured, though in some forms the sub-marginal vein is longer relatively to the marginal. The latter is of much the same form in all and can hardly be called punctiform in any.

Ooctonus Hal.

Male antennae with 13 joints, the scape flattened and short, the second joint very small and roundish, the following ones subequally elongate, flattened and wide, but not so wide as long. Antennae of female 11-jointed; scape very long, set on an elongate pedicel, so as to appear obsoletely 2-jointed, and as long as the three following joints together; club as long as the five preceding joints together. Posterior ocelli wide apart, perhaps placed close to the eye margins, the collapse of the head in dried specimens making it impossible to ascertain this point. Scutellum large and elongate, longer than the mesonotum; the axillae encroaching little or not at all on the scapulae; propodeum with two raised lines or longitudinal carinae. Tarsi 5-jointed. Apical cilia of front wings short, many times shorter than the greatest width of the wing. Abdomen pedicellate. (For figures of antennae see Pl. XIII fig. 2; the lower two antennae representing male and female of this genus.)

Ooctonus australensis, sp. nov.

Black, shining, antennae of the male black, of the female with the scape mostly pale yellowish-brown, the second joint also more or less brownish, the following three blackish, the sixth also dark but less so than the preceding, 7th, 8th and 9th white, 10th much wider than the 9th and black, club black. Legs brownish yellow or testaceous, posterior tibiae more or less darkened. Abdomen pedicellate, brownish black or piceous. Length 1$\frac{5}{8}$ mm.

Hab: Cairns, Queensland; two examples extracted from eggs of a conspicuous *Tettigonia* common in the cane fields.

Gonatocerus, Nees.

Female: Antennae 11-jointed, the scape elongate, about equal to the next three joints together, second joint widened, much wider on its flat surface than the following; flagellar joints not differing greatly in length, the basal ones being, however, rather shorter than the following; club as long or longer than the three preceding. Front wings with short apical cilia, several times shorter than the greatest width of the wing; axillae of mesonotum not encroaching on the parapsides; tarsi 5-jointed; posterior ocelli remote from the eye margins; abdomen subsessile. (Plate XIII fig. 2; uppermost antenna represents that of female of this genus; fig. 6 abdomen of the female.)

Gonatocerus cingulatus, sp. nov.

Female: Yellow; the face, the whole of the flagellum of the antennae, two adjacent spots on the front of the mesonotum which do not reach back to the middle, one on the anterior angle of the scapulae, another on each side adjoining the tegulae and a median one between these, the propodeum, the meso-and metopleura, the hind coxae, all the tibiae, the tarsi above, two bands near the middle of the abdomen (appearing as one very broad one in contracted specimens) and the sheaths of the ovipositor dark, black or blackish fuscous. The scape and second joint of the antennae and the front and middle coxae are more or less dark on their margins. Front tibiae with distinct, small, stout spines, placed remotely and in line. Length $1\frac{3}{8}$ mm.

Hab. Brisbane, Queensland; bred from the eggs of a *Tettigonia* on sugar cane (Koebele No. 2241.)

Polynema, Hal.

The single species here described under this genus has a shorter marginal vein than any of the others dealt with in this paper, but it is less punctiform than in some other species, that I have examined.

Polynema reduvioli, sp. nov.

Third and ten following joints in the male elongate, subequal, in the female the third, fourth and fifth are very slender and elongate the following three much shorter and wider, the club about as long as the three preceding together. The fringe at the apex of the front wings is much shorter than the greatest width of these. The basal joint of the hind tarsi is very long, subequal to the other three joints together.

Black and smooth, except for very fine microscopic sculpture, the three basal joints of the antennae in both sexes, all the legs, except the apical joints of the tarsi, and the abdominal pedicel are yellow, or brownish yellow. The pedicel is elongate, and about equal in length to the hind coxae. The surface of the wings is uniformly clothed with short dark hairs. Length 1 mm.

Hab: Hawaiian Islands; parasitic in eggs of *Reduviolus blackburni.*

N. B.—A second species closely allied to this, but differing slightly in color, and with a shorter marginal vein has probably similar habits, as also *P. hawaiiensis* described by Ashmead. (Faun. Haw. Vol. 1, p. 332,) which agrees in nearly all structural points with the one here described. These two species are usually bred from leaves covered with Aphis and might easily be supposed to be parasitic on plant-lice by a careless investigator.

Alaptus, Hal.

Antennae of female 8-jointed, the scape elongate, the second joint dilated and much wider than the following, third slender, elongate, rather shorter than the fourth, 5th, 6th, and 7th, increasing in width, club nearly as long as the four preceding. Antennae of male 10-jointed, the scape elongate, second wider than the following, third elongate, but shorter than the fourth, which is subequal to the following joints. Posterior ocelli close to the eye-margins, the three forming a triangle with extremely wide base. Tarsi 5-jointed. Abdomen sessile. (Plate XII, fig. 5; antennae of female in two aspects and that of the male.)

Alaptus immaturus, sp. nov.

Female: Pallid ochreous, the head sordid and also the thorax along its posterior margin; abdominal segments with obscure sub-quadrate, lateral, blackish or sordid spots. Antennae with two basal joints pale, the rest dark. Length $\frac{3}{8}$ mm.

Hab: Bundaberg, Queensland, bred from cane leaves containing leaf-hopper eggs, but I do not feel sure that it is parasitic on these.

Anagrus, Hal.

Ocelli in a subequilateral triangle, and close together, the posterior very remote from the eyes; antennae of female 9-jointed, scape long, second joint widened, third very short, the fourth and following equal, club about equal to two preceding. Antennae of male filiform 13-jointed, second joint dilated, third also wide on its flat face and short, much shorter than the following, all the other joints subequal. Axillae produced forwards into the scapular region of the mesonotum; tarsi 4-jointed, wings with long apical cilia, much longer than the greatest width of the wing. Abdomen sessile, ovipositor a little exserted. (Plate XII, fig. 4 and 6; antennae.)

Anagrus frequens, sp. nov.

Female: Orange red or reddish yellow, the occiput for a large part, the antennae except the two basal joints, two contiguous or subcontiguous large marks on the front of the mesonotum, one on the anterior end of each of the scapulae, one on the axillae, two or three of the basal abdominal segments more or less, as well as their lateral margins very narrowly, and the sheaths of the ovipositor, dark, blackish or fuscous. Wings hairy, but with a long bare area on the lower side of the apical half. Ovipositor very little exserted.

Male generally like the female apart from the structural differences in the antennae as stated above, and in the usual abdoinal characters. Markings as in the female, probably more pronounced as a rule, but similarly situated, the abdomen apically dark above. Length $\frac{5}{8}$ mm.

Hab: Queensland; bred from eggs of Delphacids. An apparently slightly different race inhabits Fiji, but I cannot separate it specifically.

Anagrus columbi, sp. nov.

Apparently almost identical with the preceding in form and structure, but at once distinguished by the fact that the hairs on the apical part of the front wing are of more general distribution and do not leave the large bare space noticeable in *A. frequens*. In specimens mounted in balsam in 1903, the color characters are as follows: Luteous, head sordid or smoky yellow, antennae with three basal joints yellow (but the scape is somewhat darkened in part) the rest fuscous. Mesonotum yellowish fuscous, the parapsides darker in front, the axillae also infuscate. Abdomen sordid yellowish. In life the markings are very probably almost identical with those of *A. frequens*, but whether the general color is as red as in that species, it is impossible to say. Length $\frac{5}{8}$ mm.

Hab: Columbus, Ohio (Koebele, No. 2320) bred from eggs of *Liburnia* on grass.

Paranagrus, gen. nov.

Like *Anagrus*, but more slender and elongate, and with the third joint of the antennae in the female elongate, not much shorter than the following and quite slender. Otherwise as in the preceding genus. Ovipositor either slightly or strongly exserted behind the abdomen. Antennae of male 13-jointed, as in *Anagrus*, but with the third joint slender and elongate, as in the female. (Plate XII, fig. 1 and 2.)

Paranagrus optabilis, sp. nov.

Male; flavous, head more or less sordid or smoky; a large elongate subtriangular spot on either side of the middle line of mesonotum, the apex of these spots reaching nearly to the scutellum; a spot usually triangular on the parapsides, and one on the axillae, dark; abdomen with at least the apical segments more or less dark, blackish or fuscous; all the joints of the flagellum smoky or fuscous.

Female, like the male, but with the thoracic markings generally much fainter, though occupying the same positions; spots on the axillae sometimes not discernable, the abdomen not dark on the apical segments. Length $\frac{3}{4}$ mm.

Hab: Queensland; bred in all localities from the eggs of *Perkinsiella saccharicida*. A very similar form inhabits Fiji, but the material is insufficient to determine whether they are specifically identical.

Paranagrus perforator, sp. nov.

Female; yellow or orange red; head subinfuscate, the whole of the flagellum of the antennae, two long triangular spots on the mesonotum, nearly or quite reaching the scutellum, one on the front angles of each of the parapsides, another on each of the axillae, an interrupted band on the first abdominal segment, and an entire one on the second and third, the lateral margins of at least some of the apical segments, and the sheaths of the ovipositor, dark, blackish or piceous. Ovipositor extending well behind the abdomen, for a length equal to that of all the joints of one of the hind tarsi taken together. Length $\frac{2}{3}$ mm.

Hab: Fiji; bred from eggs of Delphacid leaf-hoppers.

PROCTOTRUPOIDEA.

In the course of our investigation of the parasites of leaf-hopper, several species of an anomalous form belonging to the Proctotrupoid series were bred. These species, I believe, form a genus not yet described, which at present is best located in the Platygasteridae, in the group which contains the genus *Inostemma*, Hal. In some respects they remind one of the well-known egg-parasites of the genus *Bacus* and its allies, in the Scelionidae; in others of the likewise anomalous genus *Baconeura* of Foerster. They too are egg-parasites, attacking those leaf-hoppers' eggs, which are not imbedded in the tissues of plants, but such as are entirely external. The eggs that we found to be attacked by them, were those of such conspicuous leaf-hoppers, as are included in the genera *Siphanta*, *Platybrachys*, etc., and of others allied to these. These parasites are of very great economic value in Australia and without their aid, vegetation in many localities would suffer very greatly from leaf-hoppers of the genus *Siphanta*, which indeed are, as it is, quite capable of doing damage under certain conditions in that country. In many places, however, we found that from every egg in nearly every egg-mass that we collected, we bred one or other of these parasites, and further we saw them in extraordinary numbers crawling over and ovipositing in eggs in the field.

They always escape by gnawing a roundish hole in the egg, so that it is very easy to distinguish between the egg-masses from which parasites have escaped and those from which young leaf-hoppers have emerged. (Pl. XI, fig. 2, 3 and 7.) We were not able to pay very much attention to the eggs of such leaf-hoppers as those mentioned above, so that I anticipate that great numbers of species of these parasites are to be found in Australia, and probably they are represented by similar or cognate forms in other countries. The parasites themselves, when bred from eggs of such species of leaf-hoppers as cover their eggs with white mealy powder, are frequently so disguised by the adherence of this same substance, that unless it be carefully cleaned off, their proper structure and appearance cannot be made out.

GENUS AND SPECIES HERE DESCRIBED.

Aphanomerus, gen. nov.

1. *Aphanomerus bicolor*, sp. nov. et typ. gen.

2. *Aphanomerus niger*, sp. nov.
3. *Aphanomerus rufescens*, sp. nov.
4. *Aphanomerus pusillus*, sp. nov.

These species may be easily separated by the distinctions given in the table below. I may add there is another species very closely allied to *A. rufescens*, represented by a single example, which I have not thought it advisable to describe at present.

1. (6) Thorax black.
2. (5) Abdomen largely or entirely ferruginous.
3. (4) Larger; abdomen wholly ferruginous........*A. bicolor*
4. (3) Smaller; abdomen dark at least on the apical part. ....*A. rufescens.*
5. (2) Abdomen almost entirely black..............*A. niger*
6. (1) Thorax yellow or ferruginous.............*A. pusillus.*

Aphanomerus, gen. nov.

Moderately or quite robust, the head transverse, and very strongly inflexed, the ocelli very widely separated from one another, the anterior one placed very far forwards. Antennae 7-jointed in the female; 8-jointed in the male, the club solid and one-jointed in both sexes. Maxillary palpi two-jointed, labial one-jointed; mandibles bidentate. Pronotum very little visible in some aspects; the parapsidal furrows of the mesonotum fine, but evident, and widely separated even at the base; post scutellum more or less prominent in the middle. Legs with uneven claws, the one being much longer than the other. Wings with the submarginal vein terminating in a round knob in the field of the wing, and not reaching the costa, the basal nervure more or less obsolescent, the basal cell incomplete, but its position marked by a darker streak in the position of the median vein. Abdomen with longitudinal wrinkles or costae at the base. (Plate XI, fig. 1, 4 ,5, 6,, 8 and 9.)

Aphanomerus bicolor, sp. nov.

Black, the abdomen ferruginous, the antennae, legs and tegulae paler, more testaceous, the club of the antennae in the female largely dark.

Head and thorax opaque or subopaque, the mesonotum and scutellum with minute microscopic sculpture and punctuation, so that it appears coriaceous under a lens, clothed with minute gray pubescence, and with longer gray hairs at the posterior angles of the thorax. Abdomen with a series of short longitudinal costae or wrinkles at the base, and pubescent at the sides near these, the four apical segments with short grey pubescence, the large segment preceding them being smooth and glabrous. Length 1⅝ mm. (Pl. XI, fig. 1 and 4.)

Hab: Queensland; common. From one batch of eggs, Koebele (No. 2293) bred 48 parasites and 7 young hoppers. As in the other species, only one parasite emerges from each egg.

Aphanomerus niger, sp. nov.

Black, the legs and antennae for the most part yellow or ferruginous, the club of the latter infuscate in the female, the tip of the abdomen ferruginous, as well as the apical margins, very narrowly, of the second and following segments.

Thorax dull, appearing coriaceous from the dense minute sculpture, consisting of fine punctures and rugulosity of the surface, and clothed with very fine gray pubescence. Abdomen at the base with the usual row of costae and externally to these pubescent, and with very delicate microscopic rugulosity, the second segment smooth, shining and glabrous, the terminal ones slightly pubescent. Length 1¾ mm.

Hab: Bundaberg, Queensland; male and female bred from eggs of a Fulgorid on *Melaleuca* by Mr. Koebele. The specimens are unnumbered and the eggs are those of a species of *Platybrachys* or some allied form.

Aphanomerus rufescens, sp. nov.

Black, the abdomen ferruginous except at the apex and on the lateral margins, which are more or less dark; antennae and legs testaceous or yellowish, the club of the former more or less dark in the female, while in the male the dark color of the abdomen is extended further towards the base.

Head, and thorax above, subopaque or at least not very shining, with microscopic sculpture, and clothed with fine gray pubescence, the pleura for the most part smooth and much more shining, the propodeum about the insertion of the abdomen more or less pale colored, or piceous. Abdomen with longitudinal costae at the base and pubescent on either side of these; the following great segment glabrous and impunctate. Length ⅞ mm. (Plate XI, fig. 6.)

Hab: Cairns, Queensland; bred from egg-masses of Fulgorids.

Some specimens bred by Koebele are numbered 2276 erroneously, his note under that number referring to other insects.

Aphanomerus pusillus, sp. nov.

Yellowish or ferruginous, the head in the female black or dark, and the club of its antennae somewhat obscured.

Mesonotum opaque or nearly so, with dense and very fine microscopic sculpture, and minute pale pubescence, much as in the other species of the genus, the pleura smooth and shining. Abdomen with the base costate, the following large segment very smooth and shining, the rest finely pubescent. Length $\frac{7}{8}$ mm. (Plate XI, fig. 5.)

Hab: Queensland; very abundant in the eggs of *Siphanta*, and allied forms.

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DESCRIPTION OF PLATES.

Plate XI.

1 *Aphanomerus bicolor.*

2 Eggs of *Siphanta* sp. from each of which an example of *Aphanomerus pusillus* emerged.

3 Eggs of a Fulgorid, probably a species of *Platybrachys*, from which *A. bicolor* was bred. Only a few eggs are figured, but of the whole mass 48 produced parasites, and from 7 young hoppers emerged; a few others contained dead parasites.

4. *A. bicolor*; male and female antennae.

5. *A. pusillus*; male and female antennae.

6. *A. rufescens*; female antenna.

7. Eggs of a species of leaf-hopper allied to *Siphanta* all parasitized by *A. rufescens.*

8. Maxillary palpus of *A. bicolor*

9. Claw-joint of tarsus of the same, showing the unequal claws.

Plate XII.

1. *Paranagrus optabllis.*

2. Antenna of female and male of the same.

3. & 3a. Antennae of male and female *Polynema reduvioli.*

4. Antenna of female *Anagrus columbi*, in two aspects.

5. Antenna of female in two aspects, and antenna of the male, of *Alaptus immaturus.*

6. Antenna of male and female of *Anagrus frequens.*

Plate XIII.

2. Antenna of female *Gonatocerus cingulatus* above; of female and male *Ooctonus australensis* below.

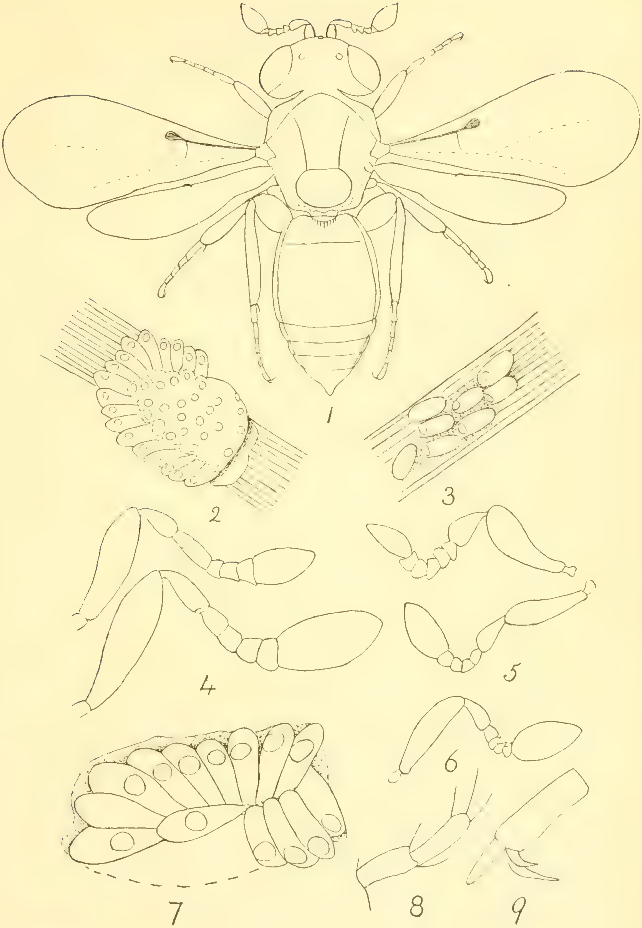
3. *Paranagrus optabilis* female, ovipositing in the eggs of *Perkinsiella*, which are imbedded in the leaf, and further hidden beneath a white mealy covering.

4. Pupa of *Paranagrus* within the egg of *Perkinsiella.*

5. Larva of the same; the egg contents had been partly removed in order that the larva might be rendered more visible, and they are not figured in the upper part of the hopper's egg.

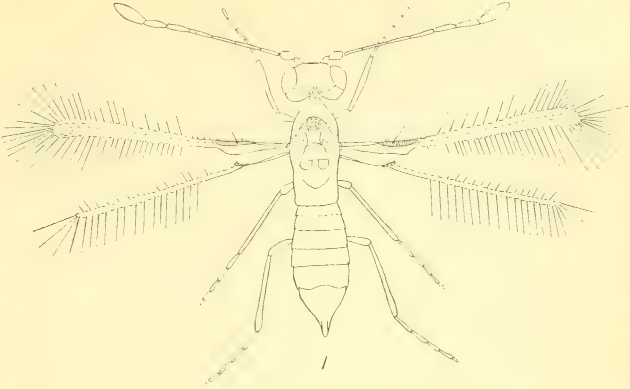
5a. Head extremity of the larva of the same.

6. Abdomen of *Gonatocerus cingulatus* showing the insertion of ovipositor at its base.
7. Upper extremity of eggs of *Reduviolus blackburni* and the exit holes of the parasite (*Polynema reduvioli*) in the surface of the cane-leaf.
8. & 8a. Diagrammatic of disposition of hairs on the surface of front wing of *Anagrus frequens* and *A. columbi.*



Perkins del.

PLATE XI.



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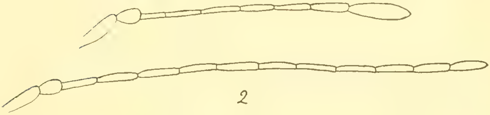

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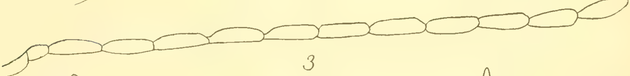

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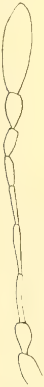

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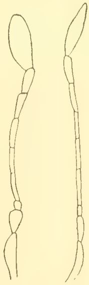

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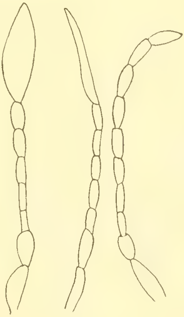

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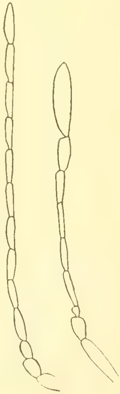

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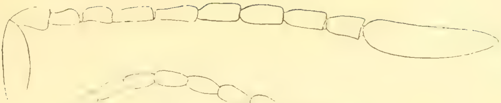
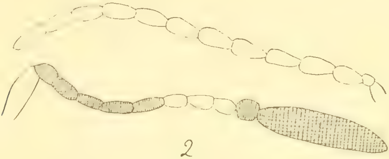
Perkins del.

PLATE XII.





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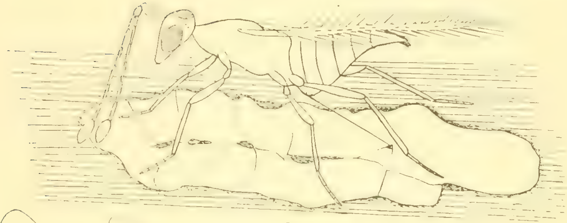

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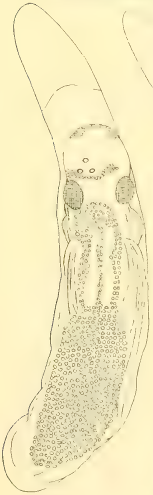

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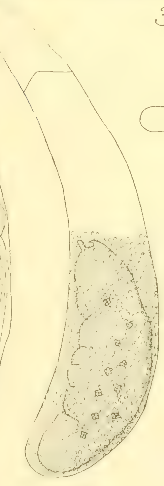

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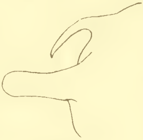

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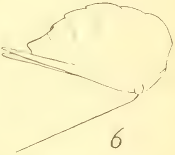

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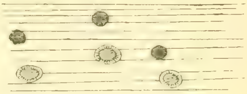

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Perkins del.

PLATE XIII.

DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 7

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. VII. ORTHOPTERA, COLEOPTERA HEMIPTERA)

BY O. H. SWEZEY

HONOLULU, H. T.
DECEMBER 30, 1905

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LETTER OF TRANSMITTAL.

Honolulu, T. H., December 1, 1905.

To the Committee on Experiment Station, H. S. P. A., Honolulu, T. H.

Gentlemen:—I herewith submit for publication the seventh part of the Bulletin on "Leaf-Hoppers and their Natural Enemies," which deals chiefly with predaceous insects established in the cane-fields, and has been prepared by my assistant, Mr. O. H. Swezey.

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

INTRODUCTORY REMARKS.

Since the cane leaf-hopper has become so abundant in the Hawaiian Islands, certain predaceous insects have taken to feeding upon them and have likewise increased in abundance; so that they are now found as constant inhabitants of the cane-fields wherever leaf-hoppers are abundant, and are of no little value in helping to check the increase of the latter.

Of the insects treated in this Part the grasshopper (*Xiphidium*) is by far of the most importance. It is not indigenous to the Islands, but from whence it came is not known. Its introduction was accidental about 15 years ago. There are many species of this genus in all parts of the world. I have seen no mention of any species being insectivorous, they being chiefly grass feeders. It is not unlikely that our species has developed its partial insectivorous habit since its introduction here, and since the increase of the leaf-hoppers to such an abundant food-supply.

The bugs (Hemiptera) treated of, with the exception of *Zelus peregrinus*, are native to the islands, and have become adapted to a leaf-hopper diet by reason of the fact that this pest furnishes a convenient and bountiful food supply. They are not feeding exclusively upon this new source of food, but may be found as well in their former habitats feeding upon their original prey.

The ladybugs treated of are primarily Aphis feeders, and have all been introduced from Australia. When found in cane-fields there is no doubt but that they have been especially attracted by the cane Aphis, which is usually more or less present in fields of young cane. *Coccinella repanda*, the ladybug which has been the longest introduced, is very common in all parts of all the islands; when in cane fields, it also preys upon young leaf-hoppers, especially when its food-supply of Aphis is scarce or has become exhausted. It is very probable that the recently introduced species will do the same when they have become established and generally distributed, and that they will be a valuable addition to the present force of predaceous insects preying upon the leaf-hopper pest.

Heretofore the life history of none of the insects herein treated has been studied. In the observations recorded in this paper, a number of new and interesting facts pertaining to life history have been brought out.

ORTHOPTERA.

LOCUSTIDAE.

Xiphidium varipenne, sp. nov. (Pl. XIV.)

(1). Distribution.

This insect, described below, has been present in these Islands (Oahu at least) for about 15 years. It was recorded by Brunner as X. fuscum in 1895. It was also collected by Schauinsland in 1896-97, and published under the same name by Alfken. It must have been introduced at Honolulu, and did not get spread far from there for several years, as Perkins says concerning it in Fauna Hawaiiensis, II, p. 14, 1899, "Only in and around Honolulu." The fact of its depositing its eggs beneath the leaf-sheaths of sugar cane makes it easy of distribution in "seed" cane, and probably accounts for its present distribution to all of the islands. It is at present very generally distributed, in fact, it might be said that they are everywhere: lowlands, valleys and mountains, gardens, pastures, and cane-fields. It is called by different names in different localities: Longhorned Grasshopper, Red-tailed Grasshopper, Brown-tailed Grasshopper, and Green Cricket being names commonly used.

(2). Feeding Habits.

Being a grasshopper of the family Locustidae, it would naturally be taken for a grass and foliage feeder, as are the majority of the grasshoppers; but observation proves it to be largely insectivorous. Whether they have always been so, may not be determined; but recently, their being abundant in sugar cane-fields and that, too, where but little evidence is seen of their having eaten cane, has led to investigation by the entomologists, and planters as well, with the result that this grasshopper is found to feed to a large extent upon sugar cane leaf-hoppers and other insects. They probably catch the adult leaf-hoppers mostly by lying in wait till a leaf-hopper approaches or alights near. In one instance an adult leaf-hopper was seen to alight immediately in front of an adult grasshopper; the latter pounced upon it instantly, securing it by means of the mandibles, and it was soon eaten. They have the habit of lurking about the axils of the upper leaves, or the crown of the cane stalk just where the leaf-hoppers congregate in large numbers in young cane, and it is easy for the grasshoppers to capture an abundance of their prey, especially the young leaf-hoppers. When confined in a breeding cage with growing cane for several days, very little eating of the cane was done; but when leaf-hoppers were introduced they were at once devoured.

Young grasshoppers were bred from the egg to maturity, being fed entirely upon leaf-hoppers and aphis. Very young grasshoppers were seen to capture and eat nymphs of leaf-hoppers of nearly their own size.

Freshly hatched grasshoppers, fed with tender *manienie* grass, died after 5 days, without having eaten a particle. Other freshly hatched grasshoppers were tried upon tender cane leaves. They died after 6 days without having eaten anything. Young grasshoppers have been seen eating the blossoms of Canna, Lantana, and other plants, so that they are not entirely insectivorous. In eating Lantana blossoms they ate through the tube of the corolla at the place where the stamens are located inside, apparently to obtain the pollen.

The eating of cane done by this insect is of no consequence. It occasionally does some ragged eating of the younger leaves near the tip. In cane-fields, I have observed them feeding to a large extent upon the leaves of *Honohono*, and the flowers of various kinds of weeds; and I have also seen them eating the seed capsules and young seeds of *Canna indica* to a considerable extent. They were very numerous in a patch of this plant growing in Makiki Valley, above the H. S. P. A. Experiment Station grounds. Examination of crops of adults and nearly full-grown nymphs collected in this patch and vicinity showed that 8.82% contained insect remains, and 91.18% contained vegetation.

Examination of the crops of a large number of grasshoppers collected on Mt. Tantalus, by Mr. W. M. Giffard, Nov. 6, 1904, gave the following results:

21.2% contained insect remains, of which 6.6% contained only insects, 14.6% contained both insects and vegetation, 78.6% contained vegetation only.

A number of grasshoppers caught in a cane-field where there were plenty of leaf-hoppers, were examined, and the crops of 30% of them contained fragments of leaf-hopper. On examination of crops of grasshoppers gathered in cane at H. S. P. A.

Experiment Station grounds, 33.3% were found to contain insect remains; leaf-hopper fragments were found in 15.5%; 15.5% contained vegetation; 40% empty.

Examination of their crops does not prove to what extent they eat leaf-hoppers, for they do not always swallow the hard parts of these. Often in the breeding cage they were seen to chew up leaf-hoppers, and reject them after sucking the blood and juices. However, from these examinations, and field and insectary observations, it is certain that this grasshopper is very extensively insectivorous, and that when present in canefields, leaf-hoppers form the chief part of its diet, and it therefore should be classed as a beneficial insect, and a highly valuable enemy of the leaf-hopper.

(3). Egg Parasite.

In March, 1905, parasitized eggs of this grasshopper were discovered in cane on H. S. P. A. Experiment Station grounds, and a pale yellow Chalcid parasite was bred from them. The number bred, ranged from 9 to 14 per Xiphidium egg, and in one instance a whole cluster of 10 eggs had been parasitized; in another case 13 eggs were parasitized. All the parasites in an egg usually issued from the same hole, (Pl. XIV, fig. 11), the first one to mature probably gnawing a hole out, and the others taking advantage of the opening already made. This tiny round hole is often made through the enclosing sheath of the cane leaf as well, where the eggs are quite tightly enclosed by the latter. Parasitized eggs were examined from which the parasites had not yet emerged. They are a bluish black in color. Larvae were found in some, and pupae in others. The pupae were not enclosed in individual cocoons.

Adult parasites were placed with fresh grasshopper eggs, in which they were soon seen ovipositing. In one case adult parasites emerged in 25 days; in others 22-24 days; in one 20 days; another 31 days; giving a range of from 20 to 31 days for the life cycle.

The shortness of life cycle compared with the length of life cycle of the host (3 months) gives the parasite the advantage, and it is likely that this grasshopper may become reduced in numbers more rapidly than it has increased since its appearance a few years ago. In fact, it has been reported as rapidly disappearing recently in the Kohala District, Ewa Plantation, and some others. This is undoubtedly due to this parasite, though its presence there has not been ascertained. The grasshoppers have similarly become scarce in the cane of the Experiment Station grounds, during the past summer.

Perhaps this parasite is more or less generally distributed. The writer has found it common where the grasshoppers were abundant on Hilo grass and Canna indica up Makiki Valley, about one mile from the Experiment Station grounds.

On a trip to the sugar plantations of Maui, in October, this parasite was found to be very rare, and the grasshopper exceedingly abundant everywhere. In the examination of 300 grasshopper eggs, in a cane-field at Lahaina, only one parasitized egg was found. From this 7 parasites issued.

Mr. Terry found that the parasite was present at Koloa, Kauai, April, 1905; and also reports that the grasshoppers are decreasing in other places on that island.

(4). Life History.

The eggs of *X. varipenne* are 5 mm. long and nearly 1 mm. in greatest diameter, blunt at one end and pointed at the other, which is the one where the head of the embryo appears. They are slightly testaceous in color at first, but become greenish as the embryo approaches time of hatching.

The eggs are laid in clusters of from 2 to 15, side by side, obliquely inserted beneath the leaf-sheaths of cane leaves (Pl. XIV, fig. 11), also those of *Canna indica*, and probably other plants. Their presence can often be noticed by a slight outward bulging of the leaf-sheath. The eggs are inserted with the anterior end outermost. They hatch in about 5 weeks. In one case, adults were placed in a breeding cage, March 28, and young grasshoppers appeared on the 35th day. In another observation, eggs laid April 6th hatched May 14th—a period of 38 days. Eggs gathered June 27th hatched through a period of 16 to 29 days, being in various stages of embryonic growth when gathered. In hatching, the egg splits on one side at the anterior end, about ⅓ length, but not extending quite to the tip.

The nymphs in all stages are green, with the dorsal, brown, pale-edged stripe of the adult. (Pl. XIV, fig. 2.)

Those bred to maturity molted 6 times (one individual 7 times), counting the final change to maturity. The molts were at intervals of 6-23 days as follows:

First molt	6-11	days.
Second “	7-23	“
Third “	9-12	“
Fourth “	8	“
Fifth “	9	“
Matured	29	“

Record of one individual.

Hatched	June 1.		
First molt	“ 7	First Stage	6 days.
Second “	“ 30	Second “	23 “
Third “	July 9th	Third “	9 “
Fourth “	“ 17th	Fourth “	8 “
Fifth “	“ 26th	Fifth “	9 “
Matured	Aug. 15th	Sixth “	20 “
		Total	75 days.

One individual matured in 111 days: (embryonic period 38 days, nymphal period 73 days.)

Measurements:

	Body	Wings	Ovipositor
Just Hatched	4 mm.	....	....
First Instar	4-5 “	....	....
Second “	6-8 “	....	1 mm.
Third “	10 “	....	2 mm.
Fourth “	11-13 “	1-2 mm.	4.5-5 mm.
Fifth “	14-15 mm.	1-3 “	10-11 mm.
Sixth “	15 “	4 “	11-12 mm.

The ovipositor makes its appearance in the second instar (1 mm.), increasing in length with succeeding stadia, but its development is not uniform per instar.

The teeth of male cerci appear in fourth instar, being very small, on inner side, near the apex; in fifth instar they are larger and about the middle of inner side.

(5). Description.

Xiphidium varipenne, sp. nov.

Bright green; fastigium reddish brown and a dorsal stripe of the same color extending backwards the whole length of the body; from the fastigium it widens to the width of the pronotum when it reaches the posterior margin of the latter; a whitish line borders this stripe on either side, sometimes obscure on the abdomen, sometimes yellowish; on either side of the abdomen of female a brownish stripe outside of the whitish line, often reddish, fainter behind; abdomen of male beyond the fourth segment bright yellowish brown. Eyes brown. Ocellus white. Antennae greenish, ringed with brown, outer part entirely brown, large basal segment with brownish spots. Mandibles black on biting edges; palpi green, more intense at the enlarged tips. Tiny brownish dots on face. Larger brownish dots on sides of pronotum, and all the femora and tibiae. Knees of posterior femora dark brown, tarsi slightly browned.

Fastigium, viewed from in front, with lateral margins distinctly diverging upwards. Posterior margin of lateral lobes of pronotum nearly straight, slightly concave; callus narrow, slightly convex; two slender prosternal spines. Anterior and intermediate tibiae with six (occasionally 7) pairs of brownish spines on under side. Posterior femora with 2 to 4 (occasionally none, only one, or as high as five) short black spines on their lower outer carinae; genicular lobes bispinose on each side. Posterior tibiae with two rows of 22-32 spines on upper side, 5 to 12 spines on under side, approximately in pairs; 2 movable spurs on each side beneath at apex, and very near the apex an additional spur on each side, the one on the outer side the larger.

Tegmina and wings nearly transparent; veins in long tegmina greenish, in short tegmina reddish in female and greenish in male. Cerci of male obtuse, depressed towards the apex, on the basal third a downward and forward projecting tooth on the inner side. Ovipositor brown, 11-13 mm.

Measurements :	Body	Hind Femora	Tegmina	Antennae	Ovipositor
Male...	15–19 mm.	12.5–14.5 mm	6-18 mm.	45-60 mm.	....
Female	15–19 "	13–15.5 mm.	4.5-20 mm.	45-60 mm.	11-13 mm.

(6). Variation.

The following tables show the variation in length of tegmina, the measurements being in millimeters:

Females.

Body	Tegmina	Body	Tegmina	Body	Tegmina	Body	Tegmina
15	4.5	16.5	6	15	6	17	7
16	4.5	17	6	15	6	18	7
17	4.75	17.75	6	17	6	17	7.25
17	4.75	16.5	6	17	6	16.5	7.5
16	5	16	6	16	6	17	8
17	5	16.25	6	16.5	6.25	16	8.5
16.5	5	17	6	17	6.25	18	10
18	5	19	6	18	6.5	18	11
16	5	16	6	18	6.5	18	12
17	5	18.75	6	19	6.5	18	12
16.5	5	17	6	17	6.5	19	13
15	5	17	6	18.5	6.5	16	15.5
17	5	17	6	18	6.5	18	17
15	5	18	6	17.75	6.5	17	17
14	5	17	6	17	6.5	18	17
17	5	16	6	19	6.5	17.5	17.5
15.5	5	18	6	19	6.5	18	17.5
14	5.25	16	6	18	6.5	17	18
19	5.5	16	6	16	6.5	19	18
16.5	5.5	16	6	18.25	6.75	17	18
16	5.5	17	6	17	7	18	18.25
16	5.5	17.5	6	17.5	7	17	19
14.5	5.5	18	6	19	7	18	20
16	5.75	16	6	18	7	......	....
16	5.75	....	....	....	.....	......	....

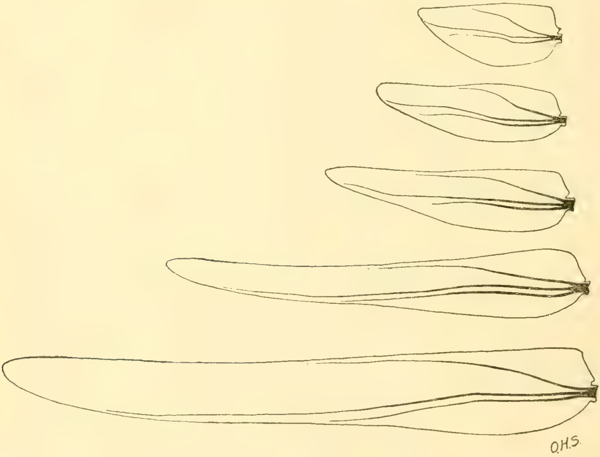
Males.

Body	Tegmina	Body	Tegmina	Body	Tegmina	Body	Tegmina
17	6	16	7	17.75	8	17	8
16.5	6	16	7	16	8	17	8
17	6.25	16	7	17	8	16	8.5
15.5	6.25	16	7	18	8	17	8.5
16	6.5	15.5	7.25	16	8	16.5	8.5
17.5	6.5	15.25	7.25	16	8	16.5	8.5
16	6.5	15.25	7.25	17	8	17.5	9
15	6.5	17	7.5	17	8	17	9
16.5	7	17.25	7.5	16.5	8	17	9
17.5	7	17	7.5	16	8	17	9
15	7	17.5	7.5	18	8	17	9
16.5	7	16	7.5	18	8	17	9.25
16	7	16	7.5	17	8	17	10
18	7	15	7.5	16.5	8	16	10.5
18	7	17	7.5	17	8	16.5	11.5
17.5	7	18	7.5	17.5	8	17.5	14.5
15.5	7	16	7.5	17	8	16.75	16
16	7	16	7.5	18	8	17	16
17	7	16.5	7.5	19	8	18.5	17
16.5	7	17	7.5	16	8	16	17
17.5	7	17.5	8	17	8	19	17
17	7	16	8	18	8	16	17
16.5	7	18.5	8	17	8	16.5	17.25
17	7	17	8	17	8	17.25	17.25
16.5	7	17	8	17	8	17	18

Specimens for the above tables were collected in Makiki Valley, Honolulu, March, 1905.

These tables show the range of variation in length of tegmina, and that the length of tegmina is not in accordance with variations in size of the body of the insect. It also shows proportionate number of specimens having the different lengths of tegmina. It is seen that specimens with short tegmina are much the most numerous in this particular locality; whereas, Mr. Perkins states that when first it became common around Honolulu about 5 years ago, there were no short-winged forms.

In the females, when the tegmina are 4.5-6.5 mm. long they extend over 3 or 4 segments of the abdomen, and the wings are slightly shorter; when tegmina are 7.5 mm. long they extend over 6 segments of the abdomen, and the wings are 1.5 mm. shorter; when the tegmina are 12 mm. long they extend about to the tip of the abdomen, and the wings are 2 mm. shorter; when the tegmina are 17-18 mm. long they extend beyond the tip of the abdomen reaching about to the apex of the femora, and the wings extend about 4-5 mm. beyond the tegmina, about to the tip of the ovipositor.



Series of tegmina of adult females, in outline, x 5½.

In the males, when the tegmina are 6.5-8.5 mm. long, they extend over 5 to 7 segments of the abdomen, and the wings are .25-1 mm. shorter; when the tegmina are 10.5 mm. long, they extend over 8 segments of the abdomen, and the wings are about 1 mm. shorter; when the tegmina are 11.5 mm. long, they reach the tip of the abdomen, and the wings are about the same length; when the tegmina are 17 mm. long they extend to the apex of the femora, and the wings are 4 mm. longer.

Observations were taken in different months of the year to determine whether the season made any difference in the length of tegmina. The following table shows the percentages of the different forms as they occurred in Makiki Valley, about one mile above the Station:

		1905				
	TEGMINA	March	July 12	Aug. 7	Sept. 20	Nov. 15
Short-winged form	(male 6-10.5 mm.	89 %	91.2 %	89.2 %	94. %	92. %
	(female 4.5-8.5 "	81.5	85.5	85.7	88.	82.
Intermediate	(male 11.5-14.5 "	2	1.1	3.1	2.	2.
	(female 10-13 "	5.1	4.5	2.4	4.	2.
Long-winged form	(male 16-18 "	9	7.7	7.7	4.	6.
	female 15.5-20 "	13.4	9.	11.9	8.	16.

From this, there is obviously no apparent seasonal variation.

Observations in the cane-fields of the Station grounds were not in accord with this, however. In March, 1905, they were nearly all the shortwinged form; but in August, there were none but the long-winged form. They were quite scarce at this time, however, only 25 adult specimens being seen in a half-hour search. In September the condition was similar. Of 36 adults seen in a half-hour search there was but one of the short-winged form.

The following table shows that the proportion of long and short-winged forms varies considerably in different localities:

	Iao Valley, Wailuku, Maui, Sept. 30, 1905	Kipahulu, Maui, Oct. 9, 1905	Pacific Heights, Honolulu, Oct. 28, 1905	H. S. P. A. Ex. Station, Honolulu, Nov. 10, 1905
Short-winged form.......	18%	16%	87%	......
Intermediate...............	2%	2%	2%	......
Long-winged form.......	80%	82%	11%	100%

There is no described species which varies so much in length of tegmina as ours does. In Redtenbacher's Monograph of the Conocephalidae, the long-winged species of *Xiphidium* are separated specifically from the short-winged species. It seems probable that many of the species described as short-winged, may be but short-winged forms of the long-winged species, or vice versa.

In the United States five species of Xiphidium have been observed to have dimorphism in the wings.

X. ensiferum Scudder, Usually short-winged; "long-winged forms are found occasionally"[°]

X. nigropleurum Bruner, "Tegmina are usually abbreviated." "An occasional specimen is to be found in which the wings are fully developed."[°]

X. strictum Scudder, "Dimorphic, the long-winged forms, however, being very scarce."[**]

X. attenuatum Scudder, Dimorphic, but only short-winged forms mentioned for Minnesota.[°] Both forms in Indiana, about equally abundant in the northern part, only the short-winged form in the southern part of State.[**]

X. saltans Scudder, Usually short-winged. "A long-winged pair August 9, 1903."[***]

I have found no mention of intermediate forms in connection with the dimorphism of these species.

Blatchley [†] says of the Genus *Xiphidium*, "Variations in length of wings seem to be abrupt with no intervening forms. There are long-winged and short-winged forms of the same species, but none with the wings of medium length. Four of our eight species are thus dimorphic as regards the length of the wings, the short-winged individuals, as far as my observation goes, far outnumbering those with the wings fully developed."

From my table of measurements it will be seen that there is a small proportion of individuals of *X. varipenne* which have wings of medium lengths. I am of the opinion that intermediate forms may yet be found in other species; and further, that more of the species may be found to be dimorphic as regards wings.

Our species was referred to *X. fuscum* Fab. by Brunner, "Orthoptera of the Sandwich Islands," P. Z. S., London, p. 894, 1895. The same name is used by Perkins, Fauna Hawaiiensis,

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[°] Lugger, Bull. 55, Minn. Ag. Exp. Station, pp. 331, 2, 3, 1897.

[**] Blatchley, 27th An. Rep. Dep. Geol. and Nat. Resources, pp. 379, 381, 1902.

[***] Walker, Can. Ent. XXXVI, p. 340, 1904.

[†] Orthoptera of Indiana, 27th An. Rep. Dep. of Geol. and Nat. Resources, p. 371, 1902.

II, p. 14, 1899. It is the *Xiphidion fuscus* (Fab.) mentioned by Kirkaldy in "A Preliminary List of the Insects of Economic Importance Recorded from the Hawaiian Islands," The Hawaiian Forester and Agriculturist, I, p. 184, 1904. It differs from descriptions of *X. fuscum*, however, in the following respects: the posterior margin of the lateral lobes of the prothorax are more nearly straight, not "strongly sinuate;" cerci of male are obtuse, not "acuminate," and the teeth are differently placed (Pl. XIV, figs. 8, 9); subgenital plate of male is truncate, and not "slightly triangularly emarginate." *X. fuscum* is an European species and less likely to have reached these islands than some species from the western coast of North America, or from Asia or Australia. Our species differs from all described species from Asia and Australia. It comes nearer to *X. spinosum* Morse, (Can. Ent., XXXIII, p. 201, 1901), occurring in California. It differs from the latter species, however, by its coloration, being green, not "testaceous;" the spines on under side of posterior femora are not "strong;" the antennae are much longer; and the ovipositor is much longer, in fact our species is quite distinctly larger in all measurements. At present the original habitat of our species is a matter of considerable doubt.

Described from numerous specimens collected in Honolulu and elsewhere in the Hawaiian Islands.

Xiphidium latifrons Redtenbacher.

Redtenbacher, Monographie der Conocephaliden, ° p. 212, 1891.

What appears to be this species was collected at Bundaberg, Australia, by Mr. Perkins. It agrees with Redtenbacher's description except that it is the long-winged form; whereas, he described it as being only short-winged.

Another closely related *Xiphidium* was collected by Mr. Perkins. These species swarmed in some cane fields of Australia.

° Reprint from Verh. der k. k. Zool. Bot. Ges. Wien, pp. 315-562, 1891. *X. latifrons* on p. 526 of this publication.

COLEOPTERA.

COCCINELLIDAE.

Callineda testudinaria, Mulsant.* (Pl. XV, figs. 1-4.)

Two specimens of this species of Ladybug, collected at Bundaberg, Queensland, Australia, by Messrs. Koebele and Perkins. and received at the Experiment Station, Dec. 6, 1904, survived. These proved to be a male and a female, and egg-laying began Dec. 15th and continued for several weeks till the death of the female. 944 eggs were produced. These hatched, and the larvae were reared to maturity. Some were sent out to sugar plantations, while others were retained for breeding. They have been breeding with some interruptions at the Station and from time to time lots of 25-50, or more, have been sent out to the plantations to start colonies of them in the cane-fields. Many plantations have been supplied already, and others will be as soon as they are bred in sufficient numbers.

In confinement this Ladybug is a very voracious feeder upon leaf-hoppers and all species of Aphis; and, as is usual with the ladybugs, both larvae and adults are equally voracious. A nearly full-grown larva, in confinement, was observed to eat 15 cane Aphids in 6 minutes; and in 24 hours had eaten 140 Aphids. Another larva ate 17 cane Aphids in 9 minutes; and 153 Aphids in 24 hours. A third larva ate 5 Aphids in 2 minutes, and 100 in 24 hours. A full-grown larva, fed upon leaf-hoppers, ate an adult and 22 medium-sized nymphs in 24 hours. The Aphids were eaten in entirety; but the leaf-hoppers were chewed up, their juices sucked, and the hard parts rejected. The larvae are very cannibalistic, eating those of their own size even, when other food is scarce. They, as well as adults, will also eat the eggs of their own species. In a cluster of eggs, if some hatch before others, the larvae are likely to eat the other eggs or such larvae as hatch later.

It is hoped that this species will be helpful in the cane-fields against the leaf-hopper. Being larger than *Coccinella repanda*, it should be more effective than the latter, when it becomes as abundant and as generally distributed.

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* Crotch, Coccinellidae, p. 161; Froggatt, Agric. Gaz., N. S. W., XIII., p. 900.

As seen from the number of eggs laid by the original female, they are very prolific and should increase rapidly in the cane-fields when they once get a start. They cling very tenaciously to objects when jarred or blown by the wind.

This ladybug may be easily distinguished by its large size, and striking markings. It is larger than our other ladybugs. It measures 5-6.5 mm. long by 4.5-5.5 wide, and is very convex. The color is a shining light yellow with black markings on the prothorax and the elytra. Those on the elytra mark them off into 5 trapezoidal areas on each elytron, somewhat resembling the plates on the back of a turtle; hence, the name "testudinaria." These black markings vary in intensity and extent; often they are distinct and perfect bands, marking off the 5 areas, but usually some of the markings are absent on the posterior part, or faint, or reduced to elongate spots.

Life History.

In the insectary, adults began copulating 7 to 20 days after reaching maturity, usually about 10 days, and egg-laying began the same day or the day following. The eggs are bright yellow, 1.5 mm. long, cylindrical, tapering at the ends, and are placed on end in clusters on the surface of leaves usually in a somewhat hidden place, as where the margin is dried and curled under. (Pl. XV. fig. 2.) The clusters contain from 9 to 64 eggs, or an average of about 30, and a cluster is deposited every day, or nearly so. One female was observed to deposit a cluster of 32 eggs in 15 minutes; another female deposited 49 eggs in 23 minutes. This is at a rate of about 2 per minute. Records of the number laid by individual females are as follows:

Egg-Laying Period.	Number of Eggs Laid.
Dec. 15th, 1904 to Feb. 1905	944
March 22, 1905 to April 28, 1905	632
May 31, 1905 to July 24, 1905	591

This shows the egg-laying period to be from 5 to 10 weeks. In each case the females laid eggs up to the time of their death, but there were fewer eggs per cluster towards the end. In the third case the female had been laying eggs for a few weeks before any record was taken. It is not unlikely that the egg-laying period would be somewhat longer when the insects are in a state of freedom.

In breeding this Ladybug, it was observed that copulation took place frequently; in fact, a pair kept in a tube by themselves were observed to copulate almost daily, or after each deposition of a cluster of eggs. The thought arose as to whether this frequent copulation was necessary for the hatching of the eggs, for with insects one copulation is the rule, even with the queen honey bee which lays eggs for a period of two or three years.

To ascertain if such frequent copulation was necessary, a female which had been laying eggs several weeks, having a male present, and copulation occurring frequently, was placed by herself. Egg-laying continued as before, with the following result:

May	31,	35	eggs;	hatched.
June	1,	33	"	"
"	2,	32	"	"
"	3,	23	"	"
"	4,	23	"	"
"	6,	11	"	"
"	7,	30	"	"
"	8,	20	"	"
"	10,	7	"	"
"	11,	24	"	"
"	12,	8	"	"
"	13,	22	"	"
"	15,	20	"	"
"	16,	6	"	"
"	17,	5	"	"
"	18,	15	"	"
"	26,	8	"	"
"	27-8,	26	"	"
"	29,	29	"	"
"	30,	21	"	"
July	2,	7	"	destroyed.
"	3,	12	"	hatched.
"	4-5,	59	"	"
"	8,	7	"	"
"	9,	7	"	"
"	10,	2	"	destroyed.
"	12,	25	"	hatched.
"	14,	18	"	"
"	15,	6	"	destroyed.
"	17,	26	"	only a few hatched.
"	20,	11	"	" " "
"	21,	10	"	" " "
"	24,	3	"	failed to hatch.
"	25,	Died.		
Total		591	eggs.	

It will be seen that she continued laying eggs for fifty-five days, until her death occurred; and that the eggs hatched, up to about the last ten days of her life when only a few hatched of those laid.

This experiment proves that the frequent copulation which had been observed during the egg-laying period was not necessary.

The eggs hatch in 3 to 6 days, usually in 4 days. The larvae molt 3 times before pupating, at intervals of 2 days and there are 5 to 6 days between the 3rd molt and pupation. In the first three stages the larvae are black. There are four rows of spiny tubercles on the back, after the third molt the head is dull yellow; broad sides of the pronotum light yellow, also the four tubercles of the first abdominal segment and the two dorsal tubercles of the 4th, 5th and 6th abdominal segments. The two dorsal tubercles on the 4th and 5th segments are often yellow after the second molt. As the larva approaches full growth it becomes lighter colored, somewhat yellowish, from the stretching of the skin between the black portions of the segments. This is especially so if the larva is very well fed. Size full grown is 11 mm. and this is attained in about 11-13 days, according to the abundance of food supply. (Pl. XV, fig. 3.)

The fullgrown larva suspends itself by the posterior end in some sheltered place, and in a day or two molts again and the pupa is formed. (Pl. XV, fig. 4.) It is about 5 mm. long by 3.5 mm. wide; light brownish yellow with black markings as follows: a pair of triangular spots on prothorax, their bases at posterior margin, often irregular lines extending from their apices to the anterior margin of prothorax; dorsum of mesothorax with 2 roundish spots at posterior margin, from these, 2 black stripes, widening posteriorly, extend backwards across the metathorax; a black line along the inner edge of the wing pads, another line parallel to it a short distance from the margin, often these lines are contiguous; a pair of black markings on each of segments 3, 4, 5 and 6 of the abdomen; those of segments 4, 5 and 6 are triangular with their bases at the posterior margin of the segments; those on the 3rd segment are quite irregular in shape longer transversely; sometimes a pair of small spots on 2nd segment.

The pupal stage lasts for 4 to 6 days, during which the adult is developing and when this is accomplished the pupa splits on the dorsal median line and the adult crawls forth. It is soft and white at first, but remaining quiet, in a few hours it becomes hardened and its normal coloration appears.

The following is a summary of the life history:

Embryonic Period	4 days
Larval Period	11-13 days
Pupal Period	4-6 days
From maturity until egg-laying begins	7-20 days
From deposition of egg till ready to lay eggs again	25-43 days

Egg-laying period about two months.

There is practically about a brood per month, throughout the year.

HAB. Southern Queensland, Bundaberg and Brisbane, Australia, on Aphis of Ficus.

Coccinella repanda, Thunb.[*] (Pl. XV, figs. 5-7.)

This ladybug was introduced from Australia several years ago. and is now distributed over all the islands. It is very abundant in many places, and feeds upon all species of Aphis. It is found in the mountains, in the valleys, in gardens, orchards and grounds, and in sugar cane-fields. Although an aphis feeder, in cane fields it feeds to a considerable extent upon young leafhoppers, especially at times when cane Aphis is scarce.

This species is of medium size, 5.5 mm. long by 4.5 broad and very convex. It is recognized by the color of the elytra, being orange-red (often paler) with 9 irregular black spots, and a black line in the middle of the back, produced by the black margins of the elytra where they come together. The prothorax is black on posterior portion; anterior portion yellowish, boundary line between is irregular. Head yellowish, with black eyes.

(1). Life History.

The eggs are yellow, often very pale, 1 mm. long. They are deposited on end, on the under side of leaves and other sheltered places, in clusters of from 2 to 18, 10 or 12 being the usual number. They hatch in 3 or 4 days; the larvae are black with white markings. They grow rapidly and molt 4 times, including the molt which takes place at pupation. The interval between molts is 1 to 2 days, and the whole larval period is 8 to 9 days, depending upon abundance of food supply.

The full-grown larvae are 8 mm. long. (Pl. XV, fig. 6.) They

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[*] Crotch, Coccinellidae, p. 117; Froggatt, Agric. Gaz. N. S. W., XIII., p. 899.

are nearly black with a bluish tinge. There are four longitudinal rows of short tubercles on the abdomen. The prothorax has a yellowish posterior margin; and there is a light yellow patch in the middle of both meso-and metanotum, a smaller one at each side of the metanotum. The first segment of abdomen has a light yellow spot in middle and two spots on each side; the fourth segment has yellow patches including 4 tubercles thus producing a nearly complete yellow band; segments, 4, 5, and 6 and sometimes 7 are yellow on the lateral edges. Very similar markings are present on the younger larvae, but are white instead of yellow.

The full-grown larva suspends itself by the posterior end in some secluded place and after hanging curled up for 1 to 2 days a molt occurs, and the pupa is formed, which is yellowish in color with roundish black spots as follows: 2 on the prothorax; 2 on metathorax, and one on the wing pad at each side of these, making a transverse row of 4 spots; 4 on the 3rd abdominal segment; 2 on the 4th abdominal segment. Length of pupa 4.5 mm. (Pl. XV, fig. 7.)

The pupal period is 3 to 4 days. The adults emerge by a dorsal splitting of pupal skin. Some reared in the insectary were observed in copulation 7 days after becoming adults, and eggs were deposited on the following day, giving a period of 23 days from deposition of eggs to the maturity of adults and another generation of eggs deposited.

HAB. China; India; Malay; Singapore; Java; Bali; Flores; Triton Bay; Queensland and N. S. W., Australia; Tasmania; New Caledonia.

(2). Parasite.

Unfortunately a parasite (*Centistes americana*) preys upon this ladybug at some seasons of the year, reducing its numbers, and thus diminishing its effectiveness. This is the same ladybug parasite which is found in the United States, and Mr. Perkins found it in Australia, also, preying upon such species as Verania lineola, V. frenata, etc.

Verania frenata, Erichs.* (Pl. XV, figs. 8-19.)

This is a medium ladybug (4.5 mm. by 3.5 mm.) introduced from Queensland, Australia, December, 1904. Of the shipment received, 14 were alive. From these, breeding has been going on with some interruptions, and colonies of adults have been sent to some of the sugar plantations. This is an Aphis feeder, but also ate young leaf-hoppers in insectary, and no doubt would feed upon them, especially the smaller nymphs, when cane Aphis became scare in the cane-fields. In Queensland, Mr. Perkins found them abundant in grass and cane-fields, feeding on Aphis. It may be identified by its tawny yellow color, with the posterior portion of prothorax black; the elytra with broad black margins where they come together in the median line, and an elongate z-shaped black mark in the middle of each.

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* Crotch, Coccinellidae, p. 175; Froggatt, Agric. Gaz. N. S. W., XIII., p. 901.

Life History.

The eggs are bright yellow, 1.25 mm. long, deposited on end, in clusters of 8 to 13 on underside of leaves, or other sheltered places. They hatch in 3 to 6 days, usually 4; the larvae molt 3 times before attaining full growth, at intervals of 2 to 4 days between molts, and about 6 to 7 days between the third molt and pupation; the whole larval period ranges from 15 days to 28 days or an average of about 19 or 20 days.

The full-grown larva (Pl. XV, fig. 9) is 7.5 mm. in length. It is without tubercles, slightly hairy, dark purplish brown, nearly black on dorsal side, with a white streak along the back, composed of large dorsal spots on each segment, beginning with the mesothoracic and terminating on the seventh abdominal segment; the dorsal spot on the fourth abdominal segment is three times as broad as the spots on adjacent segments; a lateral white line on each side, composed of spots on the edges of the segments terminating at the sixth abdominal segment, an additional white spot just above this line on mesothoracic and first and fourth abdominal segments; a median dorsal line on prothorax, widening posteriorly. These markings are not so pronounced in younger larvae.

The pupa (Pl. XV, fig. 10) is about 4 mm. long, suspended in some sheltered place. It is tawny yellow with a pair of black markings on anterior margin of prothorax, another pair on the posterior margin, also a pair on the mesothorax; inner margins of wing-pads black, faint traces of two brownish dorsal streaks on the abdomen. A spine on each lateral edge of the 3rd, 4th, 5th and 6th abdominal segments. The pupal period is 3 to 9 days, usually 4 to 5.

The summary of the life history is as follows:

Egg period 3 to 6 days.
Larval period 15 to 28 days.
Pupal period 3 to 9 days.
Egg to maturity 21 to 43 days.

HAB. Malayan Islands; Queensland, New South Wales, Australia; Tasmania; Balade, New Caledonia.

Verania lineola, Fabr.* (Pl. XV, fig. 11.)

This species was collected in Queensland and New South Wales, Aus., by Messrs. Perkins and Koebele. Several shipments of it were received at the Experiment Station during 1904. Some were liberated directly on Oahu Plantation. In a shipment received October 4, only one pair were alive, and they were retained for breeding. Their progeny were liberated on Oahu Plantation, and the plantation of Hawaiian Agricultural Co., Pahala, Hawaii, before they had increased to large numbers.

It is primarily an Aphis feeder, but ate young leaf-hoppers in confinement, and no doubt would do so in the cane-fields when Aphids were not readily obtainable. In Australia, they were found feeding on Aphis in grass and cane-fields.

In size this species is about 4 mm. long by 3 mm. wide. It is of a dull yellow color with four black spots on prothorax, 2 near the middle and two larger at the posterior margin, and 3 longitudinal black lines on the elytra, i. e., one formed by the black margin of the elytra, where they come together in the median line, and a black line near the middle of each elytron, nearer the outer margin and nearly concentric with it, sometimes terminating without reaching the margin; when it does reach the margin, it is at the inner margin a little distance from the apex.

Life History.

Eggs are yellow, laid on end, in clusters of 6 to 17, on under surface of leaves or other sheltered places; clusters deposited at intervals of 2 to 5 days.

Eggs hatch in 3 to 6 days.
Larvae full grown in 13 to 31 days.
Pupal period 4 to 8 days.
Eggs to maturity 20 to 45 days.

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* Crotch, Coccinellidae, p. 176; Froggatt, Agric. Gaz. N. S. W., XIII., p. 901.

Adults were about two weeks old when copulation was first observed; egg-laying began the same or the following day.

Full-grown larvae are very similar to those of *Verania frenata*; but at the time of writing no specimens are obtainable, so the exact distinctions cannot be given.

HAB. Southern Queensland , Northern New South Wales, Australia ; Fiji.

Verania sp. (Pl. XV, fig. 12.)

A few of this species were collected in cane-fields at Condong, N. S. W., Australia, Dec. 1904. But one individual reached Honolulu alive, and it eventually died without laying any eggs.

Size 4.5 mm. long, by 4 mm. wide; color same as *V. lineola* with heavier black markings and additional shorter black line on each elytron between those present on *lineola*.

MALACHIIDAE.

Collops quadrimaculatus Fabr.

Collected by Mr. Koebele, at Columbus, Ohio, Oct. 1903; feeding upon grass-feeding leaf-hoppers. This beetle is about 3.5 mm. long; is red with 4 bluish black spots on the elytra.

Another beetle of the same family (Malachiidae) was collected by Mr. Koebele, at Alameda, California, feeding upon grass-feeding leaf-hoppers. This is a black beetle with orange lateral margins to the prothorax; length about 5 mm.

HEMIPTERA.

REDUVIIDAE.

Zelus peregrinus Kirkaldy.* (Pl. XVI, figs. 1, 3.)

This insect was first known in the islands in 1897. It is not known from whence it came, as it is not known elsewhere. It first appeared in Honolulu, and has now spread to all of the islands, being very common in many places. It is a predaceous bug in all stages of its life, and is most commonly found upon fruit trees and shrubbery which are infested with Aphis, and in sugar cane-fields, where it feeds largely upon leaf-hoppers. When found upon fruit trees, it is usually preying upon Ladybugs which in turn were preying upon Aphis or Scale Insects, hence in this case Zelus should most certainly be considered an injurious insect. It also feeds upon Ladybugs and other beneficial insects in cane-fields, to some extent; but the number of leaf-hoppers consumed by it more than offsets the injury done by its eating an occasional Ladybug.

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* "Hemiptera," Fauna Hawaiiensis, III., pt. II., p. 149, 1902.

The nymphs of Zelus, when they hatch in a favorable place on the sheltered and secluded underside of a cane leaf, where young leaf-hoppers congregate, are in the habit of remaining in such place till they are grown to maturity, not seeking other locations unless their food supply of young leaf-hoppers becomes exhausted. I have often observed this in the cane at the Experiment Station.

An example of their voracity is shown by the following observation: 17 adult leaf-hoppers were confined with an adult female Zelus, and within 24 hours she had eaten 14 of them. This same female ate flies of various species; ladybugs, young and adult; spiders; nymphs of her own species; and, in fact, one day ate the adult male which was confined with her; in another instance a full grown nymph ate an adult which had just molted and was still soft and unprotected.

Life History.

Eggs are cylindrical, a little more than 1 mm. in length. They are laid in columnar masses of 20 to 40 eggs. (Pl. XVI, fig. 2) They are brown in color and covered with a sticky substance, the tops whitish with a depression in the center and a raised fringe at the periphery. During her life a female must lay several hundred eggs. Below is the record of one captured in the sugar cane at the Experiment Station, and fed in confinement till she died 39 days later.

May 29th, 42 eggs, hatched June 8th.
June 4th, 19 eggs, hatched June 13th.
June 12th, 34 eggs, hatched June 20th.
June 21st, 18 eggs, hatched June 30th.
June 23rd, 31 eggs, hatched July 3rd.
June 26th, 42 eggs, hatched July 6th.
June 29th, 44 eggs, hatched July 9th.
July 3rd, 39 eggs, hatched July 12th.
269 eggs.
July 7th, she died.

From this, it is seen that egg masses were produced at intervals of 2 to 9 days, or an average of 5 days. The eggs hatched in 8 to 10 days.

The nymphs molt 5 times including the final change to maturity. The following is the record of one lot bred in insectary:

	Length of Periods		Measurements	
May 29th—Eggs deposited	Egg period	10 days		
June 8th—Eggs hatched	1st stage	5 days	1st stage	2 mm.
June 13th—1st molt	2nd stage	5 days	2nd stage	3.5 "
June 18th—2nd molt	3rd stage	5-8 days	3rd stage	5 "
June 23-26—3rd molt	4th stage	5-7 days	4th stage	6 "
June 28–July 3—4th molt	5th stage	9 days	5th stage	10.5 "
July 7-12—5th molt (matured)	Whole nymphal period	29-34 days	Adult	14 "

The nymphs are more or less sticky in all stages. The abdomen is rather ovate in shape and somewhat flattened above; in the younger stages it is much tilted up behind. Eyes red; legs white, ringed and spotted with black; stages 1 and 2 have black spines at tip of abdomen. 3, 4 and 5 have the spines also on the sides of the abdominal segments, increasing in size from before backwards. Full grown nymph is of a light bluish green color, with some reddish yellow markings on dorsum, segmentally arranged. (Pl. XVI, fig. 3.)

One female from the above lot (matured July 7th) deposited an egg-mass of 45 eggs July 23rd; or about two weeks after reaching maturity. This gives a period of 55 days from laying of eggs till the young have matured and themselves laying eggs, or about 2 months, which would give 6 broods per year, providing their development was as rapid at all times of the year. Probably their development would not be so rapid during the cooler months of the year—November to March.

Reduviolus blackburni, White.* (Plate XVIII, figs. 1-4.)

This pale, grayish colored native bug is generally distributed throughout the sugar cane districts. Adults and nymphs prey upon cane-aphis and young leaf-hoppers.

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* "Hemiptera," Fauna Hawaiiensis, III, pt. II, p. 155, 1902.

Life History.

Eggs were discovered inserted in the midrib of a cane-leaf, in a cane field at the Experiment Station. The position of the eggs inside the leaf is shown in Fig. 3, Plate XVII. These eggs failed to hatch; in fact, proved to be parasitized by a black mymarid, *Polynema reduvioli*, one parasite to each egg. Mr. Terry has found *Reduviolus* eggs badly parasitized in the plantations of Kauai, also.

A female in confinement deposited 15 eggs, singly, in an irregular row in a cane-leaf. Two of these hatched in 10 and 11 days respectively. The nymphs were slender, of a pale yellow color. They molted 5 times at intervals of about 5 days (3-7), and matured in 24 days.

A darker colored species of *Reduviolus* is common in cane fields on Hawaii, and has similar habits to *R. blackburni*.

ANTHOCORIDAE.

Triphleps persequens, White.* (Pl. XVI, fig. 7.)

This little bug is very common in cane-fields, and also on any plants infested with Aphis. In all stages, they feed especially upon Aphis, but they also eat some of the younger nymphs of the leaf-hopper.

Life History.

The eggs are not known, but are probably deposited on the surface of a leaf similarly to *Physopleurella mundulus*. From some material under observation, (leaves infested with Aphis), a nymph hatched July 18th. It was yellowish in color; very active, running about; fed upon aphis; matured August 1st. Nymphal period 14 days.

Physopleurella mundulus, White.** (Pl. XVI, figs. 4-6.)

This bug is a little larger than *Triphleps persequens*. It is of a light brown color.

Generally distributed in sugar cane districts. Has habits similar to Triphleps; being larger, it undoubtedly preys to a greater extent upon young leaf-hoppers, though primarily its food is probably Aphids and Psocids. Both adults and nymphs were found on Orange trees, where they were undoubtedly feeding upon Psocids, for they were lurking about the nests of the Psocids.

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* "Hemiptera," Fauna Hawaiiensis, III, pt. II, p. 125, 1902.

** " " " " " p. 126, 1902.

Life History.

The eggs (Pl. XVI, fig. 5) are .6 mm. long, yellowish, with a raised collar or crown at anterior end, laid flat on a leaf, singly, in secluded place. Some were found under the web or nest of Psocids on Orange leaves. A few laid in confinement hatched in 4 to 5 days. The nymphs (Pl. XVI, fig. 6) are reddish in color and of very lively habits, though keeping secluded generally. I have not as yet bred any to maturity, but their nymphal period is probably about the same as *Triphleps persequens*, i. e., 14 days.

CIMICIDAE.

Oechalia grisea, Bur.* (Pl. XVIII, figs. 5-7.)

Nymphs and adults of this large native bug were found feeding on cane leaf-hoppers in the more elevated parts of sugar plantations on Hawaii, especially where they were near forests, as at Olaa, Pahala, and Naalehu. They feed on larvae of *Omiodes accepta*, also.

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EXPLANATION OF PLATES.

Plate XIV.

1. Xiphidium varipenne, female, x 2.
2. " " female nymph, x 2.

3-7 and 3a-7a. Xiphidium varipenne, dorsal and lateral views respectively of the thorax of the nymphal stages, to show the development of the wings.

8. X. varipenne, cerci of male, x 5.
9. X. fuscum, cerci of male, x 5. (From Girard, Traite D'Entomologie, Plate 62, Fig. 7.)
10. X. varipenne, fastigium viewed from in front, x 5.
11. " eggs, nat. size. Showing their location where inserted beneath leaf-sheath of sugar cane. The tiny holes in several of them are where parasites have emerged.

Plate XV. (All figures x 5.)

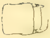
1. Callineda testudinaria.
2. " " cluster of eggs on leaf.
3. " " larva.
4. " " pupa.
5. Coccinella repanda.
6. " " larva.
7. " " pupa.
8. Verania frenata.
9. " " larva.
10. " " pupa.
11. Verania lineola.
12. Verania sp.

Plate XVI.

1. Zelus peregrinus, x 4.
2. " " nymph, x 4.
3. " " cluster of eggs, x 5.
4. Physopleurella mundulus, x 20.
5. " " nymph x 20.
6. and 6a. Physopleurella mundulus, eggs on surface of leaf x 15.
7. Triphleps persequens, x 20.

Plate XVII. (All figures x 5.)

1. Reduviolus blackburni.
2. " " surface of leaf showing external appearance of eggs which are inserted; the tiny holes at the side of several, are where parasites have emerged.
3. R. blackburni, section of leaf showing inserted eggs.
4. R. blackburni, nymph.
5. Oechalia griseus.
6. " " prothorax of another specimen showing variation in the spines at the posterior angles.
7. O. griseus, nymph.



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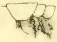

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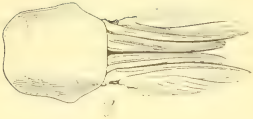

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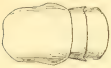

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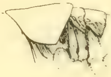

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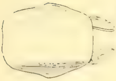

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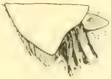

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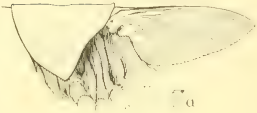

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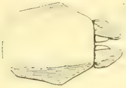

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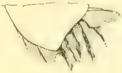

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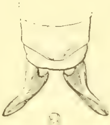

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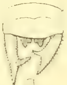

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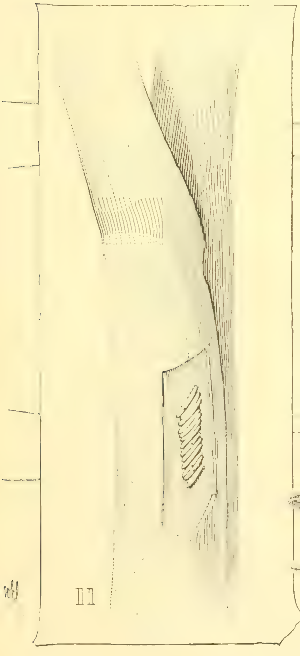

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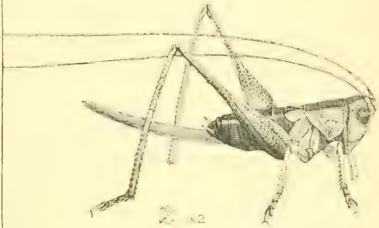

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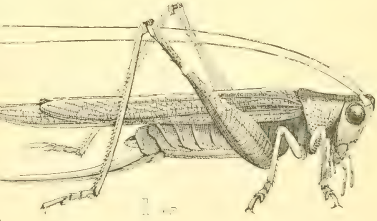

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PLATE XIV.

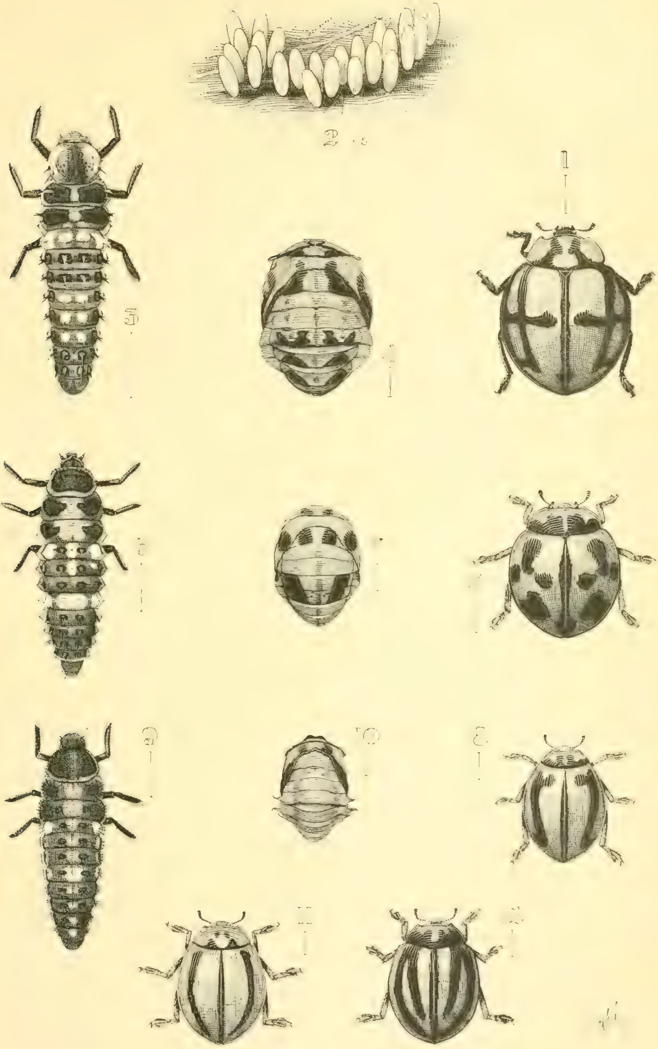
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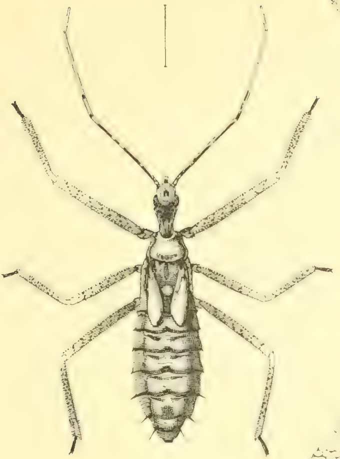
PLATE XV.

2



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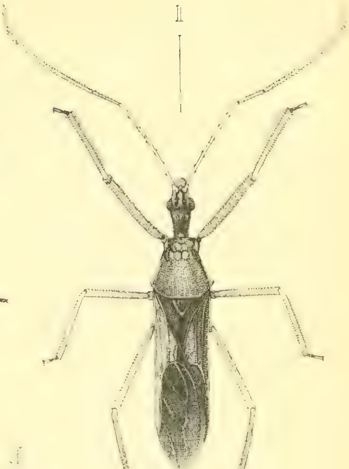

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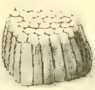

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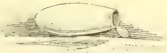

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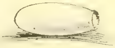

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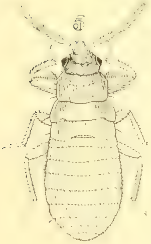

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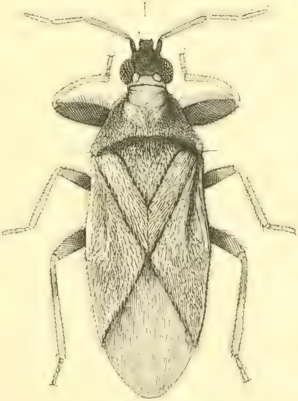

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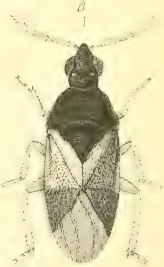

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PLATE XVI

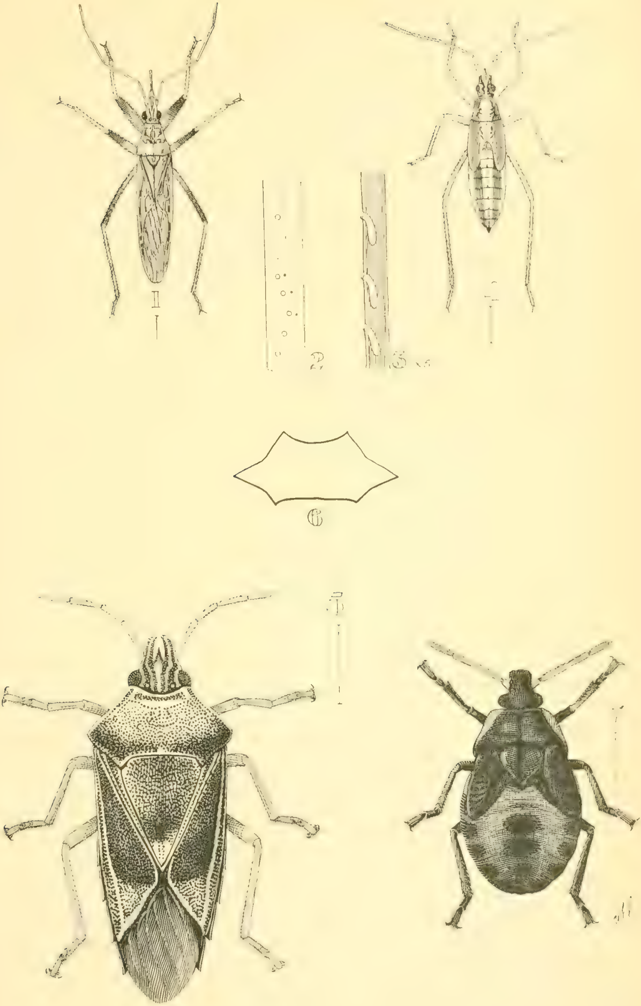

PLATE XVII.

DIVISION OF ENTOMOLOGY

BULLETIN No. 1
PART 8

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. VIII. ENCYRTIDAE, EULOPHIDAE, TRICHOGRAMMIDAE)

BY R. C. L. PERKINS

HONOLULU, H. T.
JANUARY 6, 1906

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DIVISION OF ENTOMOLOGY

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JANUARY, 1906

LETTER OF TRANSMITTAL.

Honolulu, T. H., December 1, 1905.

To the Committee on Experiment Station, H. S. P. A., Honolulu, T. H.

Gentlemen:—I, herewith, submit for publication the eighth part of the Bulletin on "Leaf-Hoppers and Their Natural Enemies," which deals with the Chalcid flies which are parasitic on the leaf-hoppers themselves, or on some of the insects that destroy them.

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

GENERAL REMARKS.

The present paper deals with such members of the great Chalcidoid series as are connected with leaf-hoppers, but excludes the Mymaridae, which have been treated of already in Part VI. of this Bulletin. I had intended to include all the species that were bred by us during our studies of leaf-hoppers in Australia, and further to describe the few species of Ichneumon flies that were connected with certain of the natural enemies of Homoptera, but these and a few of the Chalcids I have decided to leave at present undescribed. Of some of these the material for study is inadequate, and of others the habits were not sufficiently closely examined as to warrant their inclusion in this study. Further, to any one acquainted with the difficulties presented by these most extensive series of insects, and with the fact that most of the species that we obtained, belong to some of the largest and most difficult families in these series, while no semblance of a classified reference collection exists in the Hawaiian Islands, it will not be surprising that I have refrained from dealing with a few of the most obscure and difficult forms. Most of these, however, I shall refer to incidentally in the following remarks:

HABITS OF THE PARASITES HERE CONSIDERED.

We may divide the Chalcid parasites connected with leaf-hoppers into five classes according to their habits.

(1). Direct enemies of leaf-hoppers or primary parasites, i. e., those which attack these in one stage or another, from the egg to the adult.

(2). Species beneficial to leaf-hoppers, or secondary parasites, i. e., those which destroy the direct enemies or primary parasites.

(3). Species which are indirectly enemies of leaf-hoppers, or tertiary parasites, since they destroy the secondary parasites.

(4). Species which are beneficial to leaf-hoppers, since they are parasites of predatory insects that destroy leaf-hoppers.

(5). Species which are indirect enemies of leaf-hopper since they destroy the preceding.

In the first of these divisions if we exclude egg-parasites, both Mymarid and those of other families, only two primary Chalcid parasites of leaf-hoppers are known to us. These form two new and remarkable genera in the Encyrtidae and both are parasites of Jassids, in fact were bred from the same species, the one, *Meniscocephalus*, being remarkable on account of its sculpture; the other, *Neocladia*, for the fine six-branched antennae of the male and the foliaceous dilated hind legs of the female. The latter was bred from nymphs and mature specimens of the Jassid it attacks, the larva filling up the abdomen of the leaf-hopper, much as does that of a *Pipunculus* fly. The Chalcid larva, however, pupates within its host, not emerging when full fed, as does that of the parasitic fly. The mature insect escapes by rupture of the abdomen where it is attached to the thorax, just as does the larva of *Pipunculus*.

No doubt the egg-parasites of leaf-hoppers will prove to be numerously represented amongst the Encyrtidae, on future investigation. The eggs of *Siphanta* and allied genera, and those of *Platybrachys* and its allies, in fact such eggs as are not imbedded in the tissues of leaf or stem, are very subject to their attacks. Here belong the parasites described under the generic names *Fulgoridicida* and *Ectopiognatha*, and one or two other obscure and very minute species, which I have not yet adequately investigated. Apart from the Encyrtinae another egg-parasite was obtained, the species forming a new genus of the Trichogrammidae. This is a very valuable insect in that it destroys the eggs of a common Jassid, which frequents the Eucalyptus trees in Australia. It will be remembered that it has long been known that the eggs of the buffalo tree-hopper (*Ceresa bubalus*) are destroyed by a parasite of this family.

Throughout Australia and Fiji the eggs of the sugar-cane leaf-hopper are destroyed by the Tetrastichine genus, *Ootetrastichus*, hereafter described. This parasite differs in its habits from the species of *Anagrus* and *Paranagrus* of the Mymaridae, in that a single parasitic larva destroys all the eggs contained in an egg-chamber, instead of each individual being developed at the expense of only a single egg. To escape from the egg-chamber, the adult parasite gnaws a round hole for its exit, much like that made by *Anagrus frequens*, excepting that it is larger. As the number of eggs deposited by the leaf-hopper in the egg-chamber varies much, so the size of the parasites is likewise very variable, some individuals being twice the bulk of others.

On one occasion in company with the *Ootetrastichus* a single specimen of a form allied to *Oligosita* was bred by Koebele. This might be either an egg parasite of the leaf-hopper, or a secondary parasite, the latter, I suspect, being the case.

Turning to the second division, the hyperparasites or secondary parasites of leaf-hoppers, most important of these are the parasites of the Dryinidae. These comprise six distinct genera, *Echthrodryinus, Echthrogonatopus, Helegonatopus, Chalcerinys, Cheiloneurus* and *Saronotum.* I have already in Part I of this Bulletin stated the importance of these hyperparasites, in limiting the value of the Dryinidae. In the case of the first five genera named above, several individuals (frequently about half a dozen) are bred from a single host, but in the case of *Saronotum,* only a single parasite is bred at the expense of the Dryinid. This hyperparasite emerges from the Dryinid larva soon after its cocoon is formed, then continues to feed on the body for some days. The others, on the other hand, appear to emerge simultaneously, and full fed, as soon as the cocoon of their host is completed. None of these hyperparasites will oviposit in the larva of the Dryinid after the cocoon is formed, but the larva of the latter is stung, while still attached to the leaf-hopper.

The discovery of parasites on Dryinidae was made by Swezey, who obtained *Cheiloneurus swezeyi* from the cocoons of *Dryinus ormenidis* in North America. Subsequently from cocoons of the same species sent here by Koebele at least a thousand examples of this hyperparasite were bred. Ashmead on the ground that theoretically *Cheiloneurus* should be the parasite of some scale-insect, in describing the species remarked that "some mistake has been made" by Swezey, but it is he himself who is mistaken. *Cheiloneurus* is a very common parasite of Dryinidae in Australia as well as in America. *C. swezeyi* is a particularly interesting species from the fact that the female is dimorphic, being either fully winged or wingless. The latter form far outnumbers the winged in the individuals bred by me, and both were represented in Swezey's few specimens. There is no modification of the thorax in the wingless examples, which, but for the absence of these organs, quite resemble the others, though perhaps they may be of slightly smaller size on the average. We did not discover any wingless examples of the Australian species.

The only other secondary parasite of leaf-hoppers that is known to me, is likewise an Encyrtid, but belongs to the Eupelminae, while all the others belong to the Encyrtinae. It was bred from the puparium of the parasitic fly, *Pipunculus cinerascens,* and is described below as a new species of *Anastatus.* Only a single individual was bred, which emerged on the first of January, 1905, in the neighborhood of the Fiji Islands, when I was returning to Honolulu, the puparium, from which it was bred, having been collected three weeks or a month previously. This parasite escaped by a roundish hole gnawed in the top of the puparium, and did not cause the usual dehiscence of the latter, which always takes place along definite lines, when the fly emerges.

Of the third division of parasites or tertiary parasites of leaf-hoppers I have only to cite here a single species. This is a minute species of the Eulophidae, bred from the cocoons of Dryinids, parasitized by *Helegonatopus*. Only one example of this appears to have been preserved, and its condition is such that its exact position cannot be determined without additional specimens. It was bred from material sent to the islands from Ohio by Koebele.

The fourth division contains the parasites of insects that habitually prey on leaf-hoppers. Here we include the parasites of leafhopper-eating ladybirds, of the lace-wing flies (Chrysopinae) and of the hover-flies of the genus *Baccha*, as well as those of the voracious crickets of the genus *Xiphidium*, and with these may be noticed one or two species that possibly belong to the fifth division. To the parasites of the ladybirds no very special attention was paid, and they are not included in the descriptive part of this paper. Throughout Queensland we met with that common and widely spread enemy of ladybirds, the Braconid, *Centistes americana*, attacking species both of *Coccinella* and *Verania*, and what was new and interesting to us, it was also bred from a very different ladybird, the blue *Orcus ovalis*, a species most abnormal in its habits for that genus, since it feeds on fungi growing on cane leaves and grasses. Such habits are known in certain other Coccinellids but totally foreign to those of the other species of *Orcus*, which are all carnivorous. The Braconid parasite, as is well known, attacks the mature ladybird, and I have given some account of its habits in these islands in an earlier bulletin. In Australia, ladybird larvae were further infested with two species of Encyrtidae, allied to *Homalotylus*, but apparently distinct generically from that, and from one another. In the same vials with these, various other parasites emerged, supposed at the time to be secondary parasites, or possibly some of them primary ones, of the ladybirds. Amongst these was a species of the remarkable genus *Euryischia* and a Pteromalid near to and perhaps identical with the genus *Ophelo-*

sia. As the same care was not taken in isolating the parasitized ladybirds, as was given to all our other insects, the true relationship of these parasites and some others must remain doubtful. It is noteworthy that *Euryischia* was originally bred from *Lestophonus*, the dipterous parasite of *Icerya*, and *Ophelosia* as a direct parasite of that scale, while ours were supposedly bred from *Orcus* and *Verania* parasitized by other Chalcids. It would seem probably therefore that in reality some scale-insects (though hardly possibly the conspicuous *Icerya*) were accidentally included with the ladybirds mentioned, and some of these may have been further infested with parasitic Diptera. The original assignment of *Ophelosia* and *Euryischia* was no doubt made after careful study, whereas no special precautions were taken with my parasitized *Orcus* and *Verania*, as I have said.

It may be remarked that here are only mentioned such parasites as were connected with those ladybirds we wished to introduce into the islands, to prey on leaf-hopper. Other ladybirds were noticed to be excessively parasitized by quite other parasites but these are without the scope of this Bulletin.

As parasites of some of the other predaceous insects, we must notice the egg-parasite of the long-horned cricket (*Xiphidium varipenne*). I have separated this generically from the well-known genus *Aphelinus* on account of the antennal disparity in the sexes, the position of the ocelli, and some other differences. It is interesting to note that *Aphelinus locustarum* of Giraud was bred from eggs of *Xiphidium fuscum* in Europe, but whether it is generically the same as ours I do not know, as I have not the original description. Excepting these two cases, all or nearly all the Aphelininae, of which the habits are certainly known, are parasitic on scale insects (Coccidae) plant-lice (Aphididae) or Aleurodidae.

The lace-wing flies (Chrysopinae) are, as is well-known, subject to the attacks of various parasites. We may here refer to two Ichneumons, a Cryptid bred from the cocoons of a remarkable Australian lace-wing, which apparently feeds only on the nymphs of *Siphanta* and its allies; and another ichneumon of the same group, that attacks the Hawaiian *Chrysopa microphya.* In addition to these the stalkless eggs of the endemic Hawaiian genus *Anomalochrysa* are destroyed by a minute Trichogrammid, allied to *Pentarthron.*

PARTHENOGENESIS.

In Part VI of this Bulletin I have remarked on the general occurrence of parthenogenesis in the Mymarid parasites of the genera *Anagrus* and *Paranagrus*, which attack leaf-hoppers' eggs. The same phenomenon is still more apparent in the egg-parasite of the genus *Ootetrastichus*. The complete life cycle of the type of this genus is about 6 weeks, or twice as long as that of the Mymarids. I bred colonies of it from numerous parents for a period of about 8 months, but without ever obtaining a single male specimen. Specimens bred by us in Australia from egg-chambers of leaf-hopper were all females, and many reared from the same, collected by Koebele in Fiji, yielded only this sex. All specimens so far bred from Hawaiian leaf-hoppers, the parasite being now fully established in these islands, are females. It will be observed that these facts are in some respects directly opposed to those observed by Dr. Adler in the case of *Pteromalus*, since he remarks that in general the virgin females gave birth ordinarily to males only. In the Mymarids and in *Ootetrastichus* the virgin females gave birth ordinarily to females only, and in the case of the latter the other sex has not yet been seen by us, in observations extending over a year and a half. I may further remark that in the parasites of Dryinidae, *Cheiloneurus*, *Echthrogonatopus* and others, the number of males falls far short of the females, when extensive rearings are made.

CLASSIFICATION.

The greater number of species described in this paper belong to the family Encyrtidae, and to the very extensive subfamily Encyrtinae. Australia is remarkably rich in Encyrtids, though comparatively few species have been described thence. In the classification of his tribe Encyrtina, Thomson, whose keen appreciation of minute structural characters is familiar to all who have used his works, employed the structure of the mandibles for the further division of this tribe. Ashmead in his recent classification of the Encyrtinae follows Thomson, separating the genera into tribes, based mainly on these same mandibular differences. So far as the Australian species are concerned I have not been so fortunate as to be able to appreciate these structures at the value assigned to them by the Swedish and American hymenopterists, and I have had considerable doubt as to whether the minute distinctions given are really applicable to the Australian forms. The difficulties that I have encountered may be realized by any one who will examine the figures of mandibles given by me and my descriptions of other structural characters in the genera here described, and then compare them with the characters given in Ashmead's tables of tribes. Such forms as *Meniscocephalus* and *Fulgoriidecida*, which have no trace of a third mandibular tooth and would therefore fall in the tribe called Ectromini, have short stout mandibles, shorter and stouter than in many tridentate species, and do not agree in other characters with the Ectromini. Again such genera as *Echthrodryinus*, *Echthrobaccha*, and *Ectopiognatha* are difficult to place, the apex of the mandibles being very different from the ordinary tridentate form, and probably cannot be considered as having more than two real teeth. The difficulty of seeing clearly the mandibular structure is, as Ashmead observes, considerable, and no proper examination can be made in many species, without either opening the jaws, or dissecting them off. In all the species here described except one, in which the mandibles were opened, I have dissected off these appendages (generally from several individuals of each genus) and examined them in various positions as dry objects, as well as mounted in glycerine and balsam. In *Echthrogonatopus*, *Helegonatopus*, *Chalcerinys* and *Cheiloneurus* they are nearly alike, and it was not necessary to figure all these. All the figures were drawn under the high magnification of about 240, excluding those of one or two of the large species. The palpi furnish excellent characters in some cases, but I have not been able to examine them in all the genera. The posterior tibiae in *Neocladia* have two distinct calcaria, the shorter being easily visible with a lens. With the possible exception of this genus, I believe all the other Encyrtinae here described should be placed in Ashmead's tribe Mirini, though, as stated, some have only two mandibular teeth, others two more or less distinct ones and rudiments of one or even two internal to these. Cameron has noted a rudimentary second calcar on the posterior tibiae of one of the Mirini, and I have observed a very short one in one or two Australian species, but not I think in any of those described in this paper.

The other parasites present no difficulty as to the place they should occupy. The genus *Ootetrastichus* comes in the tribe Tetrastichini, amongst the genera that have no mesonotal grooved line, but appears to be very distinct from any of these.

SPECIES AND GENERA HERE DESCRIBED OR NAMED.

ENCYRTIDAE.

ENCYRTINAE.

Meniscocephalus gen. nov.
M. eximius sp. nov.
Fulgoridicida gen. nov.
F. dichroma sp. nov.
Neocladia gen. nov.
N. howardi sp. nov.
Echthrobaccha gen. nov.
E. injuriosa sp. nov.
Echthrodryinus gen nov.
E. destructor sp. nov.
Ectopiognatha gen. nov.
E. minor sp. nov. et typ. gen.
E. major sp. nov.
Echthrogonatopus gen nov.
E. pachycephalus sp. nov.
Helegonatopus gen nov.
H. pseudophanes sp. nov.
Chalcerinys gen nov.
C. eximia sp. nov.
Saronotum gen nov.
S. australiae sp. nov. et typ. gen
S. americanum sp. nov.
Cheiloneurus West.
C. swezeyi Ashm.
C. gonatopodis sp. nov.
C. chlorodryini sp. nov.

EUPELMINAE.

Anastatus Motsch.
A. pipunculi sp. nov.

EULOPHIDAE.

TETRASTICHINAE.

Ootetrastichus gen nov.
O. flavescens sp. nov.

APHELININAE.

Paraphelinus gen. nov.
P. xiphidii sp. nov.

TRICHOGRAMMIDAE.

Pterygogramma gen. nov.
P. acuminata sp. nov.

DESCRIPTION OF GENERA AND SPECIES.

Meniscocephalus gen. nov.

Robust; the head menisciform, the eyes widely separated in front, the ocelli in a triangle with extremely wide base, the posterior ones close to or touching the eye-margins, the sculpture consisting of very large deep punctures. Mandibles short, wide, and with two teeth at the apex. Antennae in the female short and stout, inserted far below the middle of the face, the funiclar joints short, and becoming wider towards the club, clothed with short bristly-black hairs; in the male the six funiclar joints are subelongate and equal, each constricted in the middle, and bearing above and below the constriction a whorl of long hairs, the pedicel being much shorter than one of these joints; the club on the other hand is one and a half times as long. In the male sex they are inserted much nearer the middle of the face. The mesonotum is about as long as the scutellum and bears appressed white setae; the axillae meet inwardly in the female but not in the male, the propodeum is clothed with conspicuous silvery hairs. Wings without a pattern in either sex, the marginal vein very short (rather longer in the male) the stigmal moderate, the post marginal not (or hardly) developed. Abdomen short and wide, depressed above, subtriangular, the ovipositor slightly exserted, the male genital armature almost entirely so.

For structural characters see Plate XVIII, fig. 7-9.

Meniscocephalus eximius sp. nov.

Head dark blue, the great punctures metallic green, the antennae yellowish, more or less sordid, largely owing to the dense clothing of setae, the club paler than the rest. In the male the antennae, except the scape, are entirely infuscate. Mesonotum dark purplish, opaque, or subopaque, punctured like the head, but not so deeply and coarsely; the scutellum very dull, the axillae touching inwardly in the female, well separated in the male, mesopleura blue, opaque. All the tarsi and the tips of the middle tibiae pale, white or yellowish. Abdomen shining blue across the base. Length about 2 mm.

HAB: Bundaberg, Queensland. An internal parasite of a Jassid.

Fulgoridicida gen. nov.

Head very wide, the hairy eyes extremely large, so that the part between them is very narrow, not more than one-third as wide as one of these; the ocelli are in the form of an isosceles triangle, considerably less wide at the base than high, and the posterior ones are close to the eye-margins. The surface of the front is dull, with excessively minute, dense sculpture. Antennae slender, with simple scape, pedicel longer than the first funicle joint, the funicle itself with six, mostly elongate, joints, the club as long or longer than the three last of these. Mandibles distinctly bidentate at apex, the palpi not examined. Thorax dull, with excessively dense minute sculpture, the axillae touching inwardly. Wings without pattern, hairy, and with very short fringe, a more or less distinct, very narrow, transverse, oblique line extending back from near the marginal vein, the latter very short, the stigmal moderately long, the post marginal not much developed. Abdomen subtriangular, wide, depressed, foveated on each side towards base, the fovea bearing short bristles; the ovipositor shortly exserted.

Male differs by the much more widely separated eyes, the space between these being about equal to the width of one of them; by the elongate funicle joints, mostly twice as long as wide, bearing conspicuous, shortish hairs, the pedicel much shorter than the first funicle joint, the club about equal to the two preceding. The head itself is much more decidedly menisciform, the ocelli are placed in the position of the angles of an almost equilateral triangle. Plate XX, fig. 3.

Fulgoridicida dichroma sp. nov.

Head dull black, scape of the antennae yellowish, or brownish yellow, the rest sordid. Thorax opaque, black with slight greenish or bluish tinge, tip of scutellum more brightly blue or green in some aspects; mesepisternum more or less brownish or piceous; legs yellow, the anterior femora more or less brown or dark. Abdomen of male very short and wide, blackish; that of the female yellow or brownish, dark apically and along the sides to near the base. Antennae of male sordid yellowish, the elongate funicle joints subequal, the pedicel much shorter than the first of these, and apparently darker than the other joints. Length $1\frac{1}{4}$ mm.

HAB: Cairns Queensland; bred from eggs of a species of *Platybrachys* or allied genus.

Neocladia gen. nov.

Head transverse, menisciform, inflexed, bearing coarse shallow punctures, the space between the eyes wide, the ocelli in a triangle much widest at base, the posterior ones being rather near to the eye-margins, only about half as far from these as from the anterior ocellus. Maxillary palpi long, 4-jointed, the first and third sub-equal, the second much longer than either of these, the fourth curved and very elongate, much longer than the second, and clothed with long hairs. Mandibles broad and apparently simply pointed in one aspect, but in others seem to have three microscopic teeth at apex. Antennae in front view of head inserted well below the middle; those of the female simple, the scape long and slender, the pedicel rather shorter than the first of the six funicle joints, which when seen at their widest, gradually decrease in length and increase in width to the sixth, which is transverse, the club oval rather longer than the two preceding joints; the scrobes short and rather indefinite. Pronotum widely rounded in front; mesonotum about as long as the axillae (which meet inwardly) and the scutellum, the latter much deflexed apically. Wings with a pattern in the female (but uniformly clear in the male) the stigmal vein long, the marginal very short, the post marginal longish in the female, and rather longer still in the male. Middle tibiae armed at the apex with denticles as also are the inner margins of the tarsi; posterior femora on the lower side, the posterior tibiae and basal joint of tarsi on the upper side foliaceously dilated, the tibiae with two distinct spurs. Abdomen small and generally distorted after drying, the ovipositor when exserted short and recurved like that of a *Pipunculus fly*. The male differs chiefly in its clear wings, much less dilated hind legs and the six long branches of the antennae, which are inserted higher up on the head.

Plate XVIII, fig. 1-6 and fig. 10.

Neocladia howardi sp. nov.

Black with various metallic reflections, the antennae with the scape ferruginous, the rest more or less obscure, becoming black or dark fuscous towards the tip, as are the branches in the male. Front and middle legs more or less yellowish-brown in the female, the middle tibiae darker, the base of their tarsi being pale, the tips blackish. Posterior legs dark, the apex of the femora white. In the male the legs are darker, but both sexes vary in this respect. Wings in the female with the apical half fuscous, paler near the tip, and containing two white spots, opposite one another, the upper placed just beyond the stigmal vein, while there is a narrow transverse fuscous band before the middle of the wing, and a more or less evident longitudinal one, extending from near the base along the lower margin of the wing. Head dull, green or purplish, and with large shallow punctures, the lower parts of the face often more shining, the mouth-parts pale. Thorax somewhat shining, distinctly but not brightly metallic, clothed with short black hairs, with indefinite surface sculpture, and excessively fine puncturation; scutellum above very dull, densely sculptured, the decurved apex smooth and shining. Abdomen black, purplish at base. Length 2-5 mm.

HAB: Bundaberg, Queensland; an internal parasite of a common Jassid. Named for Dr. L. O. Howard, who, some time since, published a very lucid paper on the Encyrtines with branched antennae, and a most interesting account of the biology of the Chalcididae. Koebele's number for this species is 2322.

Echthrodryinus gen. nov.

Head much wider than the anterior part of mesonotum, its outline subsemicircular ,the space between the great eyes very narrow, not more (where narrowest) than half as wide as one of these; the posterior ocelli close to the eye-margins, and much more remote from the anterior one than from one another, the face inflexed. Eyes clothed with very short pale hairs. Mandibles with two small, but distinct, and more or less acute teeth, and an inner apical truncation with its angle sub-rectangular, but not forming a distinct tooth. Antennae inserted near the mouth, the scrobes elongate and convergent above, the scape simple, the six funicle joints short, and not differing much in length, but the apical ones wider than the basal; the club with three subequal joints, and as long as the three or four preceding joints of the funicle; the pedicel elongate, as long, or longer than, the two first joints of the funicle, but not much thickened. Maxillary palpi short, the second and third joint extremely short, the fourth distinctly longer than either of these. Face between the anterior ocellus and the great facial impression nearly smooth, but with some sparse and very faint punctures. Mesonotum finely punctured and somewhat shining, the scutellum excessively densely sculptured except at apex, the axillae meeting inwardly. Wings with a very short marginal fringe, the marginal vein very short, the stigmal longish and clavate, the post-marginal indistinct and little developed. An oblique, hairless, transverse line, narrow above, extending from or near the marginal vein, is easily seen. Abdomen short, triangular, about as long as the thorax, concave above, the ovipositor very slightly exserted, the hypopygium not prominent. The general appearance of this genus is rather similar to that of *Parencyrtus* Ashm.

Male differs greatly from the female in the comparatively small and widely separated eyes, the ocelli in an almost equilateral triangle, and the very dense surface sculpture of the head, and the more hairy antennae, with small club-joint; the mesonotum, scutellum and head are similarly dull and densely sculptured.

Plate XIX, fig. 4.

Echthrodryinus destructor sp. nov.

Head black, the mesonotum blue, metallic, in some aspects shining, very finely punctured, and clothed with short black hairs; scutellum dull at base and with very dense microscopic sculpture, its apex in some aspects shining and brilliantly green or blue, and with some longish dark hairs; thorax beneath, and pleura black, not or hardly metallic; abdomen brightly metallic green on the basal portion. Wings hyaline, without markings, uniformly hairy, except at base, neuration obscure brownish, or brownish yellow. Antennae sordid-yellowish, clothed with short hairs. The whole of all the legs pale, yellowish. Length 1 mm.

HAB: Queensland, widely distributed; parasitic on larvae of *Neodryinus, Paradryinus* etc. Koebele's number 2232, under which are also placed specimens of the genus *Echthrogonatopus* and *Chalcerinys*.

Echthrobaccha gen. nov.

In general appearance very like the preceding genus, but the head is perhaps rather more menisciform; the front between the eye-margins is much wider, the width, in a front view of the head, through or near the anterior ocellus is about equal to the width of one of the eyes. The system of large punctures on the head is much more distinct and the punctures larger, though not dense, and becoming sparser towards the facial impression. The maxillary palpi are longer, the terminal joint much more elongate. The ocelli are more nearly in the position of the angles of an equilateral triangle, the posterior ones being well-separated from one another, but not much distant from the eye-margins. In the wings the marginal vein is rather longer. The mandibles do not differ much from those of *Echthrodryinus*, nor can the antennae be considered to present generic distinctions.

Plate XIX, fig. 2.

Echthrobaccha injuriosa sp nov.

Head black, faintly metallic, with evident large, but shallow, punctures scattered over the front, and most numerous about the ocelli; funicle joints of antennae increasing slightly and gradually in width from the second to the sixth. Mesonotum quite shining in some aspects, finely but distinctly punctured, and clothed with short dark hairs, its colour black with greenish metallic tint. Scutellum dark at base, and finely punctured; it is clothed with short hairs, and in addition bears a few erect, long ones, the apical portion is in certain aspects shining and brilliant metallic green in colour. Mesopleura black with purplish lustre. Wings hyaline and for the most part uniformly clothed with very short dark hairs; a wedge-shaped, transversely-oblique, hairless line does not reach the marginal vein. Abdomen triangular, with purplish metallic lustre. Antennae sordidly yellowish, the club generally entirely dark. All the tibiae and tarsi yellow, the front and hind femora generally largely black or dark. Length 1.25 mm.

HAB: Cairns, Queensland; parasitic on *Baccha*.

Ectopiognatha, gen. nov.

Head moderate, lower part of face much inflexed, frontal space between the eyes moderately wide, probably about as wide as one of these organs, the collapsed state of which renders exact measurements uncertain. Short pale hairs are present on the eyes, but are difficult to see owing to the condition of these being as above stated. The front has a dense microscopic sculpture and more or less evident traces of faint sparse punctures. Ocelli apparently in a subequilateral triangle, the posterior near to, but not touching, the eye-margins. Mandibles broad, with two distinct but minute teeth, and two inner angulations (or still more minute teeth?), the maxillary palpi very short, four-jointed. Antennae with dilated scape, elongate pedicel, 6-jointed funicle, and elongate, ovate club, as long as the three or four preceding joints; second and third funicle joints small and short. Mesonotum with excessively fine surface sculpture and very feeble scattered punctures, which bear distinct hairs, the axillae not touching inwardly. Wings with short marginal fringe, without markings, evenly hairy, except on a basal portion, where the hairs are sparse, an oblique bare line running from the marginal vein being perceptible. Marginal vein very short, stigmal moderate, post-marginal little developed.

Abdomen short, subtriangular, depressed above, and on each side towards the base with a fovea, which bears very long setae, often so closely appressed as to be only visible on careful examination. Ovipositor not, or scarcely, exserted.

Plate XIX, fig. 6.

Ectopiognatha minor, sp. nov.

Head metallic green, the dilated scape of antennae black, the rest pale yellowish, except the apical half of club, which is dark; the mesonotum brilliantly metallic green or brassy, pilose, shining, the scutellum usually darker, more coppery; the mesopleura shining purplish; legs almost entirely whitish, or tinged with yellow. Abdomen yellowish, bordered with dark. Length .75 mm.

HAB: Cairns, Townsville, and elsewhere in Queensland; bred from eggs of *Siphanta*. Koebele's number 2251.

Ectopiognatha major, sp. nov.

Head in front coppery, more brassy above, dull, with dense minute sculpture, the scape of the antennae black, the rest pale, the apical part of club subinfuscate. Mesonotum slightly shining in some aspects, very faintly sculptured, blue-black; scutellum dull, hardly metallic, except at tip, where in some views it is shining coppery. Legs pale, whitish. Abdomen yellowish, with a dark border. Length .75 mm.

HAB: Cairns; Queensland; a single example bred from the same batch of eggs that produced the pair of *Fulgoridicida dichroma*.

Echthrogonatopus gen. nov.

Head shaped much as in *Echthrodryinus*, the face inflexed; the eyes large, the space, where least, between them, much less than the width of one of these; face between the eyes with very minute surface sculpture, the lateral ocelli near the eye margins, the eyes themselves sparsely hairy, the hairs not very easily seen. Antennae inserted far below the middle of face, scrobes elongate, scape simple, elongate, and funicle six-jointed, the funicle joints wide and short, the club large and about as long as the funicle, the pedicel about as long as the three basal funiclar joints. Mandibles distinctly tridentate, the maxillary palpi moderately long, 4-jointed, the apical joint the longest, the labial palpi with three short joints, which together are about half as long as the maxillary. Mesonotum with short white decumbent hairs or setae; the axillae touching, or nearly touching, inwardly. The scutellum has a very dense sculpture and is extremely dull for the most part, and contrasts strongly with the metallic and finely punctured mesonotum. The wings have an obliquely transverse, hairless line (sometimes incomplete or interrupted) extending from the stigmal vein, which is short and clavate, the post marginal vein also very short, the marginal always longer than the stigmal, sometimes two or three times as long, marginal fringe short.

Male differs in its much smaller eyes so that the front between these is consequently wide, wider than one of the eyes. The face is metallic like the mesonotum, the antennae are much more elongate than those of the female, the pedicel subequal to the first of the six funicle joints, all of which are elongate; the club subequal to the two preceding.

This genus is here made to include two species, which, however, according to the views of Foerster and Ashmead would be generically separated, owing to the difference in the shape of the head, the length of the marginal vein and the position of the ocelli.

Plate XX, fig. 1 and 2.

Echthrogonatopus exitiosus, sp. nov.

Female: head with greenish or other metallic lustre, the front microscopically sculptured, rougher about the ocelli, and with traces of larger, shallow punctures. Antennae black, the club wide, flattened, subequal to the funicle. Mesonotum somewhat shining-aeneous in some aspects, finely punctate and bearing depressed white hairs; the scutellum black, dull, but with the extreme apex conspicuously metallic in some views; mesopleura purplish-black. Abdomen shining, brassy, coppery or purplish metallic on the basal part, black apically; the legs pale, yellowish.

Male in addition to the generic characters differs from the female in the pale colour of the scape, the other antennal joints being more or less sordid and bearing long hairs directed apically. Length $\frac{7}{8}$ mm.

HAB: Queensland generally; Brisbane, Cairns, Bundaberg; parasitic on *Gonatopus* and allied genera.

Echthrogonatopus pachycephalus, sp. nov.

General appearance quite like the preceding, but the head is rather strongly incrassate, the space between the great eyes extremely long and norrow, the ocelli forming an isosceles triangle, twice as high as its basal width, and the marginal vein is shorter and thicker.

Head with very dense and fine microscopic sculpture and with evidence of a few large, but very feeble, punctures in the region of the ocelli, the antennae yellowish or testaceous, not differing much in structure from those of the preceding. Mesonotum aeneous, shining, and with very dense sculpture. Legs pale yellowish. Abdomen shining metallic green at the base, elsewhere purplish black. Length $\frac{2}{3}$ mm. Male not known.

HAB: Ohio, U. S. A.; bred from cocoons of *Gonatopus* or some allied form, collected by Koebele.

Helegonatopus, gen. nov.

In general appearance and structure excessively like *Echthrogonatopus exitiosus*, but the male differs at once by the funicle having only five joints, which are very elongate, the pedicel being much shorter than the first of these; the female by the small club, only about as long as two or three preceding joints; and both sexes by the longer stigmal vein and short marginal, the latter being not or hardly longer than the former.

Plate XX, fig. 4.

Helegonatopus pseudophanes, sp. nov.

Head black, dull, with slight bluish or purplish tint, the front with excessively minute surface sculpture and some faint larger punctures in the region of the ocelli. Antennae for the most part sordid testaceous or fuscous, the funicle joints sub-elongate. Mesonotum brassy or greenish, shining in some aspects, and with the clothing of white hairs as in the preceding species; scutellum much as in *E. exitiosus*, and with the apex very brightly metallic in some aspects; mesopleura deep black or faintly purple-tinged. Legs entirely pale, yellowish. Two basal abdominal segments bright metallic green, the rest black or purplish-black. Length 1 mm.

This description is made from the female, as I have seen only one male, which was not in good condition, but enabled me to make out the antennal character described under the genus.

HAB: Ohio, U. S. A.; bred from cocoons of *Gonatopus* or allied forms, sent by Mr. Koebele.

Chalcerinys, gen. nov.

Plate XIX, fig. 1.

Differs from either of the two preceding genera in the metallic scutellum which is nearly similar in sculpture to the mesonotum, the former not being conspicuously dull and dark compared with the latter; the wings have an exceedingly short marginal vein, a longish stigmal, and the post-marginal hardly developed. In the male the antennal structure is quite different from that of either *Echthrogonatopus* or *Helegonatopus*, from the latter in the six-jointed funicle, from the former in the very short pedicel, greatly shorter than the large basal joint of the funicle, and from either by the peculiarly former scape, as figured (Pl. XIX, fig. 5.) The antennae of the female much resemble those of *Helegonatopus* and are utterly different from those of *Echthrogonatopus*. The front between the eyes in the female is wider than in either of these genera, and in the male is very wide, the eyes bing quite small compared with those of the female. The mandibles are tri-dentate, with the inner tooth smaller; the palpi I have not been able to examine. The axillae appear to be slightly separated. The eyes are sparsely hairy.

Plate. XIX, fig. 5.

Chalcerinys eximia, sp. nov.

Metallic green, or in parts brassy-yellowish, the mesopleura and abdomen black, at most slightly metallic, antennae yellowish or testaceous, more or less sordid, legs yellow except tips of tarsi. Head densely and minutely sculptured, and with evident traces of larger, very feeble punctures; posterior ocelli nearer to the eye-margins than to one another. Thorax with very dense, minute sculpture, the mesonotum and scutellum with similar and inconspicuous pale pubescence, the scutellum smoother and more shining apically. Abdomen subtriangular, depressed above. Male like the female, but with the eyes very widely separated and with long antennae, the scape, and first joint of funicle distinctly marked with black, the club slender and elongate, dark, the pedicel small, dark coloured or largely so. Length ¾ to 1 mm.

HAB: Sydney, N. S. W., Childers and Bundaberg, Queensland; parasitic on small wingless Dryinidae of the genus *Gonatopus* or its allies.

Saronotum, gen. nov.

Of rather slender and elongate form; head in front view subelongate with the eyes of moderate size and diverging apically, the front with dense microscopic sculpture of the surface and sometimes with very faint punctures in addition. Ocelli in an isosceles triangle, the posterior near to the eye-margins and also nearer to one another than is either to the anterior ocellus. Antennae with simple elongate scape, and gradually clavate to the apex, the pedicel and basal funicle joints much less wide than the apical ones, the club small, the pedicel shorter than the first joint of funicle. Mandibles tridentate. Maxillary palpi with very long apical joint, subequal to the other three joints together. Labial palpi short, the middle joint extremely short. Mesonotum with appressed pubescence, the scutellum with erect tuft of bristles. Wings infuscate on more than the apical half, the submarginal vein much decurved before reaching the marginal, the latter long, the stigmal rather short, the postmarginal little developed. The basal third of the wings is nearly bare and from the marginal vein a very narrow, oblique, bare line runs back into this portion. Hind legs long and slender. Abdomen rather elongate, pointed at the apex, depressed above, the ovipositor not (or hardly perceptibly) exserted. Male not known.

Appears to me to be allied to the species of *Cheiloneurus*, that are parasitic on Dryinids, but the elongate form and the ovate or subelongate head, as viewed from the front, will readily separate it.

Saronotum australiae, sp. nov.

Head dull, submetallic, the face below the antennae and the scape testaceous or ferruginous. Mesonotum somewhat shining, aeneous, clothed with appressed, short, white hairs; scutellum yellow, the parapsides browner; propodeum very smooth and shining, brassy; mesopleura purple, metapleura with white hairs. Legs brownish-yellow or testaceous, the middle and posterior tibiae and the posterior femora dark, blackish or piceous for the most part. Abdomen shining brassy at the base, the rest brown. Wings with a small basal cloud, and one over more than the apical half ,leaving, however, the extreme tip and two minute obscure spots (one at the tip of the marginal vein, the other nearly opposite this) more or less whitish. Length $1\frac{3}{4}$ mm.

HAB: Bundaberg, Queensland; parasitic on *Pseudogonatopus.*

Saronotum americanum, sp. nov.

Extremely like the preceeding, but distinguished at once by the dark parapsides and anterior part of the scutellum. Head piceous black and very faintly metallic, face above the antennae with the shallow punctures quite noticeable, and more numerous than in the preceding; scape of antennae and face below the antennae brownish. Mesonotum somewhat shining in some aspects, but the surface generally appearing dull from the dense clothing of white hairs; scutellum ferruginous, dark along the anterior margin, as also are the parapsides; mesopleura, propodeum, legs and wings as in *S. australiae.*

HAB: Ohio, U. S. A.; probably rare as only one example was bred from the many Dryinid cocoons sent by Koebele.

Cheiloneurus Westwood.

Cheiloneurus swezeyi Ashmead.

Cheiloneurus swezeyi Ashmead, Ent. News. Philad. XIV, p. 193.

HAB: North America; a very common parasite of *Dryinus ormenidis*, Ashm. Hundreds if not thousands of specimens emerged from the cocoons of that species, collected by Mr. Koebele in Ohio and elsewhere.

Cheiloneurus gonatopodis, sp. nov.

Ferruginous or yellow, the club of the antennae, and usually the basal part of the hind tibiae, blackish or infuscate. Ocelli placed on a submetallic area and forming a triangle with narrow base, but hardly twice as high as wide at the base. Eyes with a very few, short and indistinct hairs. Scape of the antennae very slender, cylindrical. Mesonotum with a basal transverse blue band, which is silvery from the clothing of white setae, that it bears; propodeum at the sides dark. Wings infuscate on more than the basal half, except that the tips and around the margins they are nearly hyaline; a darker transverse mark, bearing long black setae, is placed near the base of the marginal vein. Abdomen dark at the tip and also so marked on each side at the extreme base; behind the latter marks there are on each side of the body some very long black setae. Length 1 mm. (Plate XIV, fig. 3.)

HAB. Queensland, generally distributed; Cairns, Kuranda, Bundaberg, Childers; parasitic on *Pseudogonatopus*, *Echthrodelphax*, etc. Koebele's number 2264.

Cheiloneurus chlorodryini, sp. nov.

Very like *C. gonatopodis* and *C. swezeyi* in general appearance, but may be at once known from the former by the absence of the metallic hind-margin to the mesonotum, which however has the same silvery clothing.

Scape of antennae well rounded on the lower side and distinctly dilated. Eyes in a front view of the head strongly converging anteriorly, so that the space between them is, where least, excessively narrow, not very much wider than an ocellus. The ocelli are placed in the form of an excessively elongate triangle, the anterior one being extraordinarily remote from the posterior. The hairs on the eyes are excessively short, but numerous. The scape of the antennae is yellowish, its lower margin dark; the pedicel and funicle entirely white, the club black. The wings are as in *C. gonatopodis*. Length 1½ mm.

HAB: Kuranda, Queensland; taken out of the cocoons of *Chlorodryinus*.

Anastatus Motsch.

The single species here described agrees very well in most respects with *Anastatus* reared from the eggs of Locustidae. The outer calcar of the posterior tibiae is minute compared with the inner, but nevertheless quite visible without the use of a compound microscope. The eyes are collapsed, and I cannot be sure whether they are bare or hairy, but I believe the former to be the case. We should therefore place this insect, following Ashmead's tables, in the genus *Calosoter* Walk. and far from *Anastatus*, but in these tables there is confusion as regards the condition of the eyes, *Solindenia*, a form with very large, hairy eyes, being placed in the bare-eyed group, and again in those tables there is confusion as to the condition of the axillae. Cameron remarks not only that his genus *Solindenia* has hairy eyes, but also that European *Calosoter* has the same, and that the middle tarsi of the latter are not setose. For the present, therefore, I refer this hyperparasite of leaf-hopper to the common genus *Anastatus*, to which at least it is closely allied.

Plate XX, fig. 5.

Anastatus pipunculi, sp. nov.

Head and face reddish purple, the vertex with short black hairs; the face with white, short, but conspicuous, pubescence; the surface dull, rough with indefinite sculpture. Antennae subclavate, entirely dark, metallic in some aspects. Eyes divergent anteriorly, the ocelli in a triangle much widest at the base, the posterior near the eye-margins. Thorax blackish-purple, the mesonotal ridges, sharp, parallel, the clothing white and conspicuous and, like the sculpture, very similar to that of the face. Wings fuscous, hairy, a hyaline, hairless, narrow, slightly curved, transverse band beneath the marginal vein, and a clear space at the base of the wing. Stigmal vein long, but less so than the postmarginal. Tarsi more or less yellowish-brown, the posterior darker, nearly the whole of the hind legs being blackish as is the greater part of the middle and front tibiae, their femora also being largely dark brown or blackish. Abdomen purplish black, depressed on the basal two-thirds, and with a transverse subbasal white band; the three segments following this subequal in length. Ovipositor hardly exserted. Length 2 mm. when scarcely fully extended.

HAB: Bundaberg, Queensland; parasitic on *Pipunculus cinerascens*.

Ootetrastichus, sp. nov.

Head strongly transverse, fully as wide as, or wider than, the thorax, where this is widest, the ocelli in a slightly curved line (or extremely wide triangle) the posterior being very much more distant from one another than is either from the anterior. Antennae with seven distinct joints and a ring-joint, which under high powers of the microscope appears composite, as if compounded of two or three fused joints; the scape slender and long, the pedicel elongate, the first funicle joint very long, narrowed on its apical part, the two next funicle joints shorter than the first, but elongate; the next joint is shorter and wider and, in some aspects at least, appears to belong to the club, as its apex is closely applied to the base of the apical antennal joint; the latter is without any distinct divisions, and is probably the true club. Mesonotum without a grooved line; the scutellum with four, two dorsal and parallel, each placed just within the setigerous tubercles, the other two lateral. Wings evenly hairy, marginal vein fully as long or rather longer than the submarginal, and three or four times as long as the stigmal, the apical fringe longish and continued round the costa to the marginal vein, and on the opposite margin half-way to the base. Abdomen longer than the head and thorax, depressed above, acuminate, the ovipositor slightly exserted.

Plate XX, fig. 8.

Ootetrastichus beatus, sp. nov.

Pale yellow or greenish yellow with the following parts dark fuscous or black: Two subcontiguous spots on the mesonotum in front, extending on to the pronotum and there connected. One at each posterior hind angle of the pronotum. The anterior angles of the parapsides and of the anteriorly-produced axillae, a line and one or two obscure marks near the tegulae; four microscopic setigerous dots on the scutellum, one pair of which are before the middle, the other pair at the hind margin; propodeum towards the sides, four or five pair of lateral dorsal spots on the abdomen (a pair to a segment), the ovipositor and the tip of the tarsi. In certain lights these dark spots show metallic green reflections. Thorax above with very fine microscopic longitudinal rugulosity; basal abdominal segments with two or three setigerous dots on each side, the apical ones with a complete transverse row. A long sinuate seta on each side of the abdomen near the tip, which is sparely pilose. The markings are subject to slight variations only. Length variable, generally about 1 mm.

HAB: Queensland generally, also Fiji; on leaf-hoppers' eggs. Koebele's number 2230.

Paraphelinus, gen. nov.

Like *Aphelinus* in most respects, but differs from the rather numerous species known to me in the narrower, more elongate wings, the apex of the stigmal vein being situated just about the middle of their length, and in the generally more slender and elongate body, the abdomen twice or more than twice as long as its greatest width and somewhat acuminate. The ocelli are placed in the form of a very wide triangle, the posterior ones close to the eye margins. The antennae are 6-jointed and dissimilar in the sexes; in the female the club longer than the three preceding funicle joints, the first of these very short, the second also short but longer than wide, the third about twice as long as the preceding and subequal to half the club, the pedicel elongate. Male with elongate pedicel, followed by two extremely short joints, almost like ring-joints, the following (or third funiclar) joint very elongate much more so than in the female, not very much shorter than the elongate club, which is not very different from that of the female.

Plate XX, fig. 6.

Paraphelinus xiphidii, sp. nov.

Yellow, the head more ferruginous, the abdomen at the sides with indefinite dark lateral spots, one on each side of the segments, which are subequal in length; mesothorax with a row of setae on either side of the middle line, parallel to one another; two in a line on each side of the scutellum, wider apart than those on the mesothorax; a few other setae on the thorax exterior to those already mentioned; clear oblique hairless line of front wings very distinct, extreme base of wing also nude, the apical fringe not very short. Described from specimens in balsam. Length 1 mm. or more.

HAB: Hawaiian islands; parasitic in eggs of *Xiphidium varipenne* Swezey.

Pterygogramma, gen. nov.

Head strongly transverse, ocelli in a triangle with very wide base, the posterior ones touching the eye-margins. Antennae apparently six-jointed, counting an extremely short ring-joint, the three terminal joints apparently form a widely dilated but pointed club, the terminal joint in some aspects almost spinose in appearance; pedicel widely ovate, the scape also apparently somewhat dilated. Owing to the thinly laminate character of the joints, the antennae are subject to much distortion. Scutellum rather less long than the mesonotum ;the metanotum pointed posteriorly and produced over the base of abdomen; the latter elongate and acuminate, twice as long as the thorax, and apparently laterally compressed somewhat like some Mymaridae; the ovipositor exserted for a length nearly equal to the hind tarsi. Wings with the lines of hairs rather confused, and about 7 or 8 in number, the apical fringe not very long.

Plate XX, fig. 7.

Pterygogramma acuminata, sp. nov.

Head and mesonotum ferruginous, or brownish, the latter with a pair of fuscous marks in front; scutellum, and rest of thorax above, pale yellow; abdomen black. Wings more or less fuscous on the basal half, the dark colour tending to form three dark areas. Tarsi and the tibiae more or less pale yellow, the femora for the most part blackish or infuscate, the middle and posterior pair pale at base and apex. Length ¾ mm. The specimens were badly preserved and mounted in balsam.

HAB: Bundaberg, Queensland; bred from eggs of Jassid embedded in twigs of Eucalyptus. Koebele's number 2298.

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For the purposes of this paper it is not necessary to refer to more than the few works cited below:

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DESCRIPTION OF PLATES.

Plate XVIII.

1. *Neocladia howardi*, female.
2. Mandible of the same in two aspects.
3. Maxillary palpus.
4. Antenna of male.
5. Hind leg of female and male.
6. Part of middle leg of female.
7. *Meniscocephalus eximius*, wing.
8. Mandible of the same.
9. Antenna of female of the same.
10. Part of neuration of *Neocladia* male, very greatly magnified.

Plate XIX.

1. *Saronotum australiae*, wing, antenna, maxillary and labial palpus, and mandible; all from female specimen.
2. *Echthrobaccha injuriosa*, wing, maxillary palp, mandible and antenna of female.
3. *Cheiloneurus gonatopodis*, antenna, maxillary palp, mandible, and part of neuration of female.
4. *Echthrodryinus destructor*, maxillary palp, mandible, funicle and club of antenna, and part neuration of female; antenna of male.
5. *Chalcerinys eximia*, wing, antenna, and part neuration of female; whole antenna of male, and scape and pedicel in a different position.
6. *Ectopiognatha minor*, wing, part neuration, mandible, maxillary palpus, and antenna of female.

Plate XX.

1. *Echthrogonatopus exitiosus*, antenna of male and female; wing, part neuration more enlarged, mandible, maxillary and labial palpus of female.
2. *Echthrogonatopus pachycephalus*, antenna, part of neuration, and head of female; the head of *E. exitiosus* figured alongside for comparison.
3. *Fulgoridicida dichroma*, antenna, part neuration, and mandible of female.
4. *Helegonatopus pseudophanes*, antenna of male and female, and part neuration of latter.
5. *Anastatus pipunculi*, antenna, wing and posterior calcaria of female.
6. *Paraphelinus xiphidii*, wing and male and female antenna.
7. *Pterygogramma acuminata*, wing and antenna of female.
8. *Ootetrastichus beatus*, antenna in two positions and wing of female.

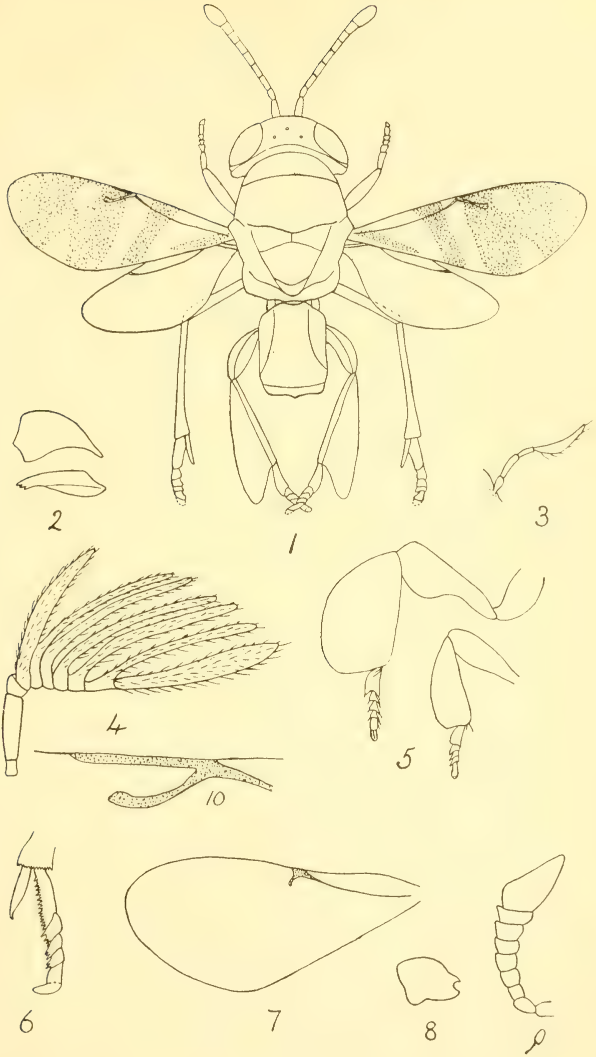
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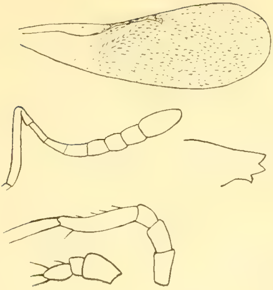
PLATE XVIII.



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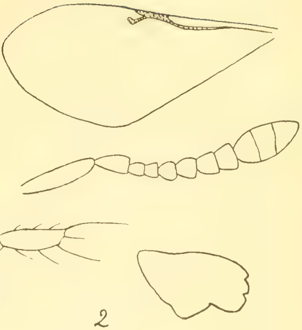

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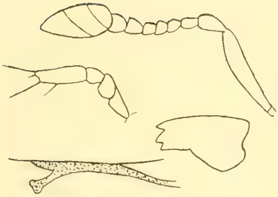

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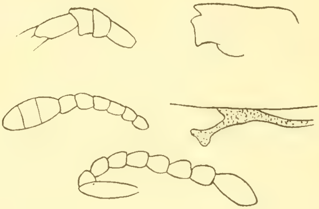

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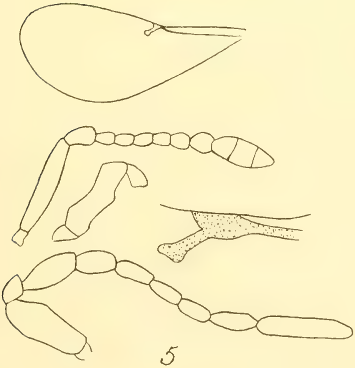

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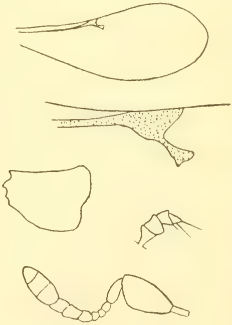

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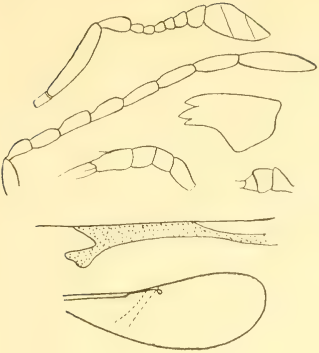
PLATE XIX.



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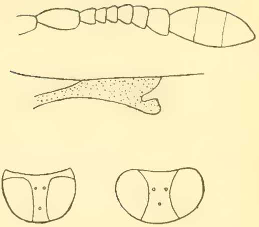

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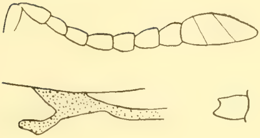

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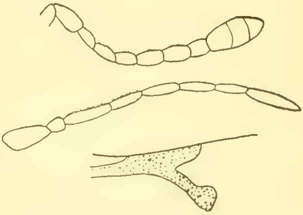

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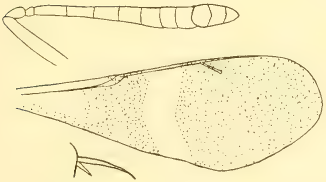

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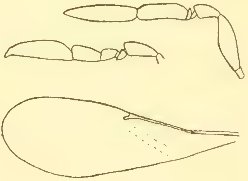

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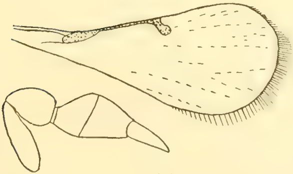

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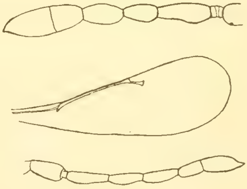

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PLATE XX.

DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 9

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. IX. LEAF-HOPPERS--HEMIPTERA)

BY G. W. KIRKALDY

HONOLULU, H. T.
FEBRUARY 3, 1906

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(PT. IX. LEAF-HOPPERS--HEMIPTERA)

BY G. W. KIRKALDY

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LETTER OF TRANSMITTAL.

Honolulu, T. H., January 17th, 1906.

To the Committee on Experiment Station, H. S. P. A., Honolulu, T. H.

Gentlemen:—I, herewith, submit for publication the ninth part of the Bulletin on "Leaf-Hoppers and Their Natural Enemies," which deals with the Leaf-Hoppers themselves, and has been prepared by Mr. G. W. Kirkaldy, Assistant Entomologist of this Division.

Yours obediently,

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Director, Division of Entomology.

GENERAL INTRODUCTION.

The Hemiptera, or Rhynchota, are readily distinguished from all other orders of insects by the structure of the mouth, which consists of a grooved sheath, usually in the form of an elongate proboscis, in which lie enclosed four setae; in some respects the Order is perhaps the most isolated of all true insects, and is certainly in many more, one of the most interesting.

As Dr. Sharp has very truly said, "there is probably no order of insects that is so directly connected with the welfare of the human race as the Hemiptera; indeed, if anything were to exterminate the enemies of Hemiptera, we ourselves should probably be starved in the course of a few months."

It is not alone the exhaustion consequent upon the rapid draining of the plant's juices by the Hemipteron's almost microscopic mouth-setae, that is so deleterious; it is the addition of the horde of fungus spores which often subsequently attack the wounded surface, and quickly multiplying, penetrate into the tissues of the plant, causing decay and death.

Here should be noted a common error among entomologists who are not specialists in Hemiptera. The probocis-like rostrum (*labium*) probably *never* penetrates the tissues, neither vegetable nor animal, unless these be already lacerated by the setae; it is simply a sheath to protect the delicate piercing organs, and more or less of a fulcrum to steady their operations.

Such injurious Hemiptera as the Chinchbug (*Blissus leucopterus*) the Bed-bug (*Clinocoris lectularius*) the Cotton Stainer (*Dysdercus suturellus*), the Coffee-blight (*Helopeltis antonii*), the Plantlice (*Aphidae*), the White flies (*Aleyrodidae*) and the Mealy bugs and Scales (*Coccidae*), are household names and to these must be added the Sugar-cane Leaf-hopper (*Perkinsiella saccharicida*).

Six hundred million dollars would be an exceedingly conservative estimate of the values of the damage occasioned all over the world each year by the depredations of the Hemiptera, taking everything into consideration.

And one cause of this devastation is the extraordinary rapidity of increase, which were it not for restraining parasites and predators, would in a year or two leave not a single green leaf on the earth. Osborn estimates that in North America, one-fourth, if not one-half, of all the grass growing annually is destroyed by leaf-hoppers.

The calculations of Reaumur and Huxley regarding the increase of parthenogenetic Aphidae are classic; Reaumur thought that one Aphid might be the mother of 5,904,900,000 in one month, while Huxley supposed that the tenth brood alone of a single Aphid—*if all the members survived*—would contain more ponderable substance than half a million of stout men. Buckton, however, shows that this is much underestimated and calculates that at the expiration of *300 days*, the progeny of one Aphid (each Aphid producing 20 only) would be the 15th. power of 210, which is the almost inconceivable number of 17,000,000,000,000,000,000,000,000,000,000! and this, I believe, is really considerably underestimated.

In comparison with these stupendous figures, the generation of the cane leaf-hopper sinks into insignificance, but taken by itself is sufficiently serious.

It is very difficult to base calculations on this extraordinarily variable insect in respect of the number of eggs deposited, and the length of time taken for their metamorphoses, but supposing each hopper to lay only 50 eggs, (the sexes to be about equal) and there to be but 6 broods in the year, then the undisturbed progeny of one impregnated female would amount in one year to very little less than 500,000,000.

As an offset to this, there are but few beneficial Hemiptera. The predaceous Reduviidae often attack our friends and foes indiscriminately, for example it seems a matter of indifference to *Zelus peregrinus* whether it seizes the destructive *Perkinsiella* or the friendly *Coccinella*. Certain Coccidae exude merchantable wax and others provide formerly important dyes, while certain waterbugs furnish food for game and cage-birds or even to some races of man, but the total value is insignificant.

BIOLOGICAL SURVEY.

(a) LIFE HISTORIES OF HOPPERS.

Compared with the Life Histories of Hymenoptera, Diptera, and certain Coleoptera, for example, those of the leaf-hoppers are, as a rule, of small interest.

The outward form, at least, is generally, in the nymphal instars, very similar to that of the adult, the latter differing principally in maturation of the organs of flight and reproduction, together with an increase in the number of tarsal segments, and modifications, mostly slight, in the form of the head.

There is also comparatively little scope for multifariousness in the *habits* of the leaf-hoppers. Some are ~~abnormal,~~ arboreal others live among grasses and lowly herbage; some in dry pastures, others in reedy margins of lakes and streams. Many are attended more or less assiduously by ants, a few are found actually associated with the latter in their nests, though their role there is unknown. Some are solitary, other herd in flocks, among the most curious of the latter being such genera of the Derbinae as *Philadelphcia* and *Sardis* which sit on the undersurface of leaves in ordered rows with their elongate tegmina raised perpendicularly over the back.

The different superfamilies may be easily recognized apart, in the nymphal instars as in the adult state. The Fulgoroidea are extraordinarily sensorized, the head being almost always furnished with many specialized sensory pits, these often occuring also on the nota, tegminal pads and even on the abdomen. I believe that the number and disposition of these organs will prove of great value in future classification. The genae, antennae, etc., are much as in the adult.

In the other superfamilies the pits are apparently entirely absent, though there are sometimes simple, scattered piligerous pits on the abdomen. The Cicadoidea have the anterior femora greatly thickened and spinose. The nymphal Tetigonioidea partake of the general characteristics of the adults, tho in the Membracidae, many nymphal forms are very strongly granulate. These granulations, however, not being pierced or piliferous. (Pl. XXIV, figs. 10-12.)

(1). Tetigonioidea.

Tetigoniidae: Osborn and Ball are the only authors who have paid much attention to the metamorphoses of this family, having worked out in part many of the North American graminicolous species.

The ova seem to be always elongated, subcylindric, and are deposited on the stems under the leaf-sheaths or in the leaves of the food-plants.

Omitting of course the usual development of the tarsi from two segments to three, of the nota and flight organs, and the genitalia, the Tetigoniidae seem to alter exceedingly slightly during their metamorphoses, the head being the principal seat of change. In many forms in which the head is short and more or less transverse in the adult, it is considerably produced and sometimes more or less foliaceous in the nymphs; I would intance *Epipsychidion epipyropis* (Pl. XXIII fig. 6) from Australia, bred up by Koebele and Perkins.

In *Xerophloea viridis*, the nymphal vertex is more angulate anteriorly, while in *Euacanthus acuminatus* the almost rectangular, adult vertex is very strongly produced before the eyes in the nymph, being as long as wide, anteriorly rounded and distinctly hairy.

The complete metamorphoses of the dimorphic *Dorycephalus platyrhynchus* are described and figured by Osborn and Ball, the lengthening and changes in form of the head being shown.

In some Agalliinae the nymphs seem to foreshadow those of the Membracidae. *Agallia 4-punctata* and *A. novella* (as figured by Osborn and Ball) have the tergites in profile serrate, and the former has two subhorizontal, apically truncate, capital processes, while the adults in *Pediopsis* have the vertex deeply angulately emarginate basally, this being truncate in the nymphs. The nymphs, moreover, of certain American and Australian forms are quite hairy.

The metamorphoses (partially or complete) are shown by Osborn and Ball of the following Tetigoniids of interest to workers of the Australian fauna, viz: *Parabolocratus viridis*, *Phrynomorphus* (*Athysanus*) *obtutus*, *Deltocephalus abbreviatus* and other species, *Platymetopius cinereus*, *Idiocerus alternatus* and other species, *Lonatura catalina*, *Driotura robusta*, *Phlepsius nebulosus*, etc.

The following nymphs of Australian forms are now figured; viz: *Tetigonia parthaon*, *Epipsychidion epipyropis*, *Rhotidus flavomaculatus*, *Stenocotis planiuscula*.

The colour and pattern of many nymphs is quite different from that of the adults, and will undoubtedly prove a valuable aid in the identification of many closely allied species.

Membracidae: The metamorphoses of this bizarre family are but little known, thought the American *Ceresa bubalus* has been more or less worked out.

The eggs are placed in small compound groups, arranged in two nearly parallel or slightly curved slits in the twigs of certain trees, the number in each slit varying from six to twelve, while there may be as many as ten slits filled. These eggs have been figured by Riley and by Marlatt and copied into various works. According to Buckton (Pl. 49 fig. 6C) "*Oxyrhachis lignicola*" deposits its eggs in grooves in the bark of leguminosae.

Nymphal stages have been figured by Riley, Green, Buckton, Scheller and others; these differ from the adults by the absence, either wholly or in part, of the pronotal hood, while the tergites are often furnished with long filaments or with spinose projections. The caudal end of the abdomen is also, in certain forms, furnished with a retractile process, which will be briefly discussed when considering the relations of leaf-hoppers to ants.

Of Australian species, Goding has figured *Zanophara tasmaniae*, *Sextius depressus* and an unknown nymph of probably the same genus as a specimen collected at Kuranda; it probably refers to a new genus in the neighborhood of *Hypsoprora* Stal, and is now figured to display the characteristic granulation of membracid nymphs. (Pl. XXIV fig. 11 and 12.)

A second specimen, also from Kuranda (fig. 10) is undoubtedly membracine, but can scarcely refer to any described genus. It measures 7 mill by 5 mill, is flat and strongly foliaceous and strongly granulate in patches. The basal half of the vertex is porrect, very transverse, being 4 to 4½ times as wide as one of the *dorsally*-situated eyes, very deeply roundly emarginate in the middle so that the vertex is very nearly linear. It is also deeply emarginate (but less so) submedianly; it is about three times as wide as long at its longest point. The anterior half of the vertex is perpendicular, the disk deeply excavate, transverse, strongly granulate, spinose behind the eyes. The flat face is of course overshadowed by the underside of the vertex. The figure shows the remarkable general appearance.

In the *Cercopidae* the nymphal instars of some genera are well known to every one in Temperate Zones, owing to their habit of establishing themselves on the stem or leaf of some herb or tree, and enveloping themselves in their own frothy secretion (see for example De Geer, more recently Porter and Fabre, also for curious American forms, Ball.) The name of "Cuckoo Spit," applied to these forms in Europe, dates from classic times, when it was believed that the insects were born from the saliva of cuckoos; the French "Crachat de Grenouille" indicates credence in another supposed origin. The adults are termed "Froghoppers" in England. The nymphs and adults of *Philagra parva* swarm in Australia on *Casuarina* trees, the former enveloping themselves in froth after the manner of *Cercopis*. The nymph of the Madagascan *Ptyelus goudoti* Bennett, possesses the power of discharging clear water in such considerable quantities as to resemble light rain, this activity being naturally greater at noontide. Goudot estimated that some seventy individuals could emit a quart in an hour and a half.

It has been stated (see, for example, Amyot & Serville) that the nymphs are thus enveloped to guard them from carnivorous insects; on the contrary, DeGeer notes, what has been often observed since, viz: that these nymphs are frequently ravished from their spume by small Fossorial Hymenoptera, while Birds are also said to prey upon them. The froth in reality serves to protect their soft bodies from the heat of the sun, as when taken from this cover and not allowed moisture with which to re-envelope themselves, they soon shrivel up and perish.

Certain Australian forms, however, construct calcareous cases of helicoidal or serpulideous form and attach them to twigs; usually of *Eucalyptus*. These cases were discussed twenty years ago by Ratte since when nothing original has been published on them.

The case is fixed to a twig from two to seven feet above the ground, generally a little or immediately above the insertion of a leaf; and its opening is turned upwards. The shape varies according to genus and species. Some figured by Ratte are actually helicoidal, from this they uncoil till forms are found which are quite or almost straight, though tapering, the widening from the base of course corresponding to the growth of the nymphs. *Polychaetóphyes* Kirkaldy has larger, coarser tubes, somewhat stalactitic in ornamentation, while those of *Pectinariophyes* Kirkaldy are smaller and more delicate. The position of the larva within is reversed, the head being placed downwards, (Ratte says that the helicoidal form is an exception,) so that the anus is found at the mouth of the tube. Under cover of the case, at the basal end of which is a slit, the nymph sucks the sap of the tree; occasionally it moves backwards and emits a drop of clear liquid at the mouth of the tube which is habitually half or nearly full of this liquid, the production being increased in warm weather. Eucalypti are rich in calcium compounds and the lime of the shell is evidently derived from the sap of the tree. Ratte roughly calculated a proportion of 75 per cent of carbonate of lime, the insoluble remains being considered as chitinous matter. In the nymph, two of the tergites (apparently 2nd and 3rd in the forms I have seen) are curiously modified, being much enlarged and more strongly chitinized than the rest of the abdomen, there is a longitudinal false suture. This structure acts as an operculum. (Pl. XXIII figs. 12 and 13.)

Ratte describes them all under the generic name *Ptyclus*, but I cannot place them there and moreover at least four genera are required for their reception. *Polychaetophyes* and *Pectinariophyes* are described later on.

The nymphs of the Sinhalese *Machaerota guttigera* Westwood, construct tubes fixed to the twigs of *Adansonia digitata*, liquid exuding drop by drop from the mouth of the tube.

(2) Fulgoroidea.

As previously mentioned the nymphs in this superfamily are extraordinarily richly endowed with special sensory organs, i. e., large, punctured, granules. I have reframed from discussing the grouping of these organs in the various subfamilies, as my material is as yet insufficient.

Fulgoridae: The nymphs in the family seem to resemble the adults very strongly, but the stages have not been worked out. *Pyrops* has been figured by Burmeister.[*]

Asiracidae: I have observed the metamorphoses more or less completely of several species, but only outline them here, as later on, I hope to be able to compare all the stages in a number of forms. The study of the nymphal instars will, it is evident, be a great aid in the natural classification of this difficult group.

Perkinsiella saccharicida.

(Pl. XXVI, figs. 1-5.)

Copulation takes place at night, the adult hoppers, most of which lie still or hidden by day, emerging in crowds from their concealment at or shortly before dark.

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[*] Townsend has noted the oviposition of the Cixiine *Oecleus*, (Psyche 1892 VI, 353) and Osborn has related the life-habits of the root-inhabiting Cixiine *Myndus radicis* (Ohio Nat. 1903 IV, 43.)

"The eggs are laid in a chamber formed by the ovipositor of the female in the tissues of the leaf or in the stem of the cane. The ovipositor is held at right angles to the ventral surface, and its point of attachment just behind the posterior legs is very clearly seen when the tip is inserted into the tissues of the leaf. The number of eggs contained in one of these chambers varies considerably. Lately in Hamakua district I carefully opened some hundreds of these chambers and found the number of eggs in each to be from one to twelve in number. That end of the eggs which is nearest the external surface is the head of the future leaf-hopper and the red pigment spots, which form the eyes of the newly-emerged insect, are conspicuous at some distance behind the narrow apical extermity of the egg before it hatches. In the leaves the eggs are deposited on either surface of the thicker parts, and being of elongate form, they usually reach about half way through the tissues. The scar is always visible and is often covered with a little whitish excretion.* The apex or head of the eggs is generally just about level with the surface of the leaf, but sometimes they even protrude a little from the orifice of the chamber. The young emerge perpendicularly, head first, sometimes two together from the chamber, and as they emerge, the appendages at first apparently stuck to the body become free, and the little insect is at once active, and may be seen to perform peculiar sidling or retrograde movements similar to those of older ones or of the adult. As a number of individuals generally hatch from a single chamber, and as the chambers are extremely numerous in a single leaf, very many being sometimes present in a square inch of surface, and as also in stripped cane thousands of these chambers may be present in a single stick, the total number of leaf-hoppers that can, and sometimes do, emerge from a single stick and its crown of leaves is almost incredible.

"The young when they hatch are of sociable nature and gregarious and especially congregate at the base of the leaves, and this habit is also largely retained by the adults, which often also form large flocks in the seclusion of the youngest leaves of the crown. It is in the immature stages while growth is proceeding that the chief damage to the cane is done and the great excretion of the honey-dew taket place." (Perkins.)

The first nymphal instar is conspicuous on account of the

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* The secretion is very feeble compared with that of the Antillean *Stenocranus saccharivora* (Westwood), or some of the North American species investigated by Swezey.
G. W. K.

produced head. The vertex is a trifle longer than wide, extending well in front of the eyes and wider between them than an eye. I cannot trace any transverse or discal keels. On the frons there are *two keels* (which do not meet on the vertex or elsewhere), which are rounded convexly. These do not unite at the apical margin of the frons, nor do they meet the lateral keels there. The frons exterior to these submedian keels is wide and covered with sensory organs. The second segment of the antennae is large and stout but short. I cannot trace any sensory organs. The tarsi are bisegmentate,, the posterior pair being provided each with a small mobile spur.

The second and third instars are not remarkable, except that the spur lengthens, the head shortens and the usual changes take place in the thorax. The fourth instar is very close to the adult, except that the body is still covered with sensory organs and the submedian keels are still separate, not uniting at the apical margin of the frons. In this instar, the sensory organs on the antennae are very conspicuous.

That the study of the nymphal instars will prove very helpful to a knowledge of the adults, may be inferred from the genera *Peregrinus* and *Phacalastor*. The only conspicuous difference between *Peregrinus maidis* (the "Corn-hopper") and *Phacalastor pseudomaidis* (the "false Corn-hopper") is that in the former the tegmina are plain, in the latter the veins are very strongly and closely granulated. However, in the former the nymphs are smooth and unicolorous (yellow), in the latter they are granulate and are whitish, spotted and banded with dark brown. Unfortunately, nymphs of the other species of the genus were not obtainable to determine whether these characters are generic or only specific.

Mr. Ballou kindly sent me eggs, nymphs and imagines of *Stenocranus saccharivora* (too late for study in time to incorporate with this part); the ova are deposited in sugar cane after the fashion of *Perkinsiella*, but are somewhat densely covered with white flocculence, as are the nymphs and the adults.

Eutropistidae. Under the name *Dictyophora pallida*, Cotes has figured some of the stages of an*Eutropistid*. Probably a new genus is required, as *Cicada pallida* is not a *Dictyophorine*. Cotes refers it to subfam. "*Eurybrachydinae*."

The eggs are laid along the natural hollow of the midrib of sugar cane (not inserted, as in the Asiracidae) in masses, each cluster containing from three to thirty eggs; these are thickly covered with flocculence. The nymphs have elongate heads, but feebly so compared with the adult.

In the *Poekillopteridae*, Swezey has partially worked out the life-history of the North American *Ormenis septentrionalis*, while the allied *Siphanta acuta* has been partially worked out by myself in these islands.

In the Sinhalese *Phromnia marginella* (Fabr.), the eggs are laid in considerable numbers in the bark of the twigs of *Elaeodendron* and are apparently thickly covered with flocculent matter. The nymphs cluster like sheep* on the plant and thickly covered by the white flocculent matter. This is by no means true wax, as it consists of fibrous matter, which does not melt, but decomposes when heated and does not dissolve in naphtha. This flocculence is very characteristic of the Fulgoroidea, being more or less present in almost all (all?) forms. In some (*Cixius* etc.) it forms a short broad appendage to the body; in *Phromnia, Phenax, Lystra* and others it is long, even enormously long, as much as 5 inches in *Phenax auricoma,* both in nymphs and adults. Sharp states (Insects II 576) that this "wax" is used by the Chinese for candles and other purposes and is said to be much esteemed in India. He is however, merely repeating an old tale, the error of which was exploded by Cotes in 1893. The Indian flocculence is not commercially esteemed, and the Chinese wax is manufactured from Coccids of the genera *Ceroplastes* and *Ericerus.* The metamorphoses of *Phromnia* have been figured in part by Cotes.

The as yet small and little known sub-family Amphiscepinae (Acanaloniinae) seems to be a development of the Poekillopterinae (Flatinae) in the direction of disintegration of the tegminal venation; the posterior tibiae are spineless (or at least only bristly) in the adult, but Swezey, who has partly worked out the life-history of the North American *Amphiscepa bivittata,* has discovered an interesting fact, viz: that the nymphs have three spines on the posterior tibiae like the typical Poekillopterinae. *Amphiscepa,* however, was placed by Stal in the Issinae.**

(b) FLIGHT ORGANS.

Leaf-Hoppers seem, as a rule, to be nocturnal, flying and feeding at that time. The power of flight, however, may be said to be, as a whole and comparatively speaking, feeble; although doubtless capable at times of extended flight, particularly when aided or compelled by the wind, as a rule they seem to prefer, by day, at least, to trust to their legs for locomotion, as indeed is implied by their popular name. "On certain occasions, however ,they have been seen flying in one direction in the day time in such numbers as to form a migratory swarm, quite like that which occurs in the case of certain locusts, dragon-flies, butterflies and other insects." "It would appear from observations made, that these leaf-hopper migrations are largely due to the fact that the food supply in the place whence they originate has become exhausted or impoverished by the number of the insects." (Perkins.)

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* The natives of Garhwal in India "eat the sugary secretion and call the insect *Dhaberi,* i. e. "sheep," on account of their habit of clustering together and jumping away when disturbed." (Cotes, p. 97)

** The life history of the remarkable *Bruchomorpha oculata* is recorded as having been related by Uhler in the Standard Nat. Hist. II, 231.

The maximum amplitude, in comparison with the size of the body, is attained by the Poekillopteridae, which however, are but feeble flyers; actual extent is greatest among the Fulgoridae, which likewise are not distinguished for powerful flight. In many Issidae and other forms, tegmina are fully developed, but are corneous and often convex, while the wings are also often rudimentary. Perhaps the most remarkable tegmina are found in certain Derbidae, (*Philadelphcia &c*) in which they are very elongate and narrow.

In this group is developed very largely the remarkable and little understood phenomenon of pterygo-polymorphism; that is to say that in the same species there may be two or more forms of tegmina and wings—sometimes a sexual di-or polymorphism, sometimes not—from completeness to great reduction or almost entire absence. It is especially encountered in the Asiracidae and in the Tetigoniid *Phrynomorphus* and its allies; in the Heteroptera it occurs extensively in the Gerridae and Nabidae.

Among Hemipterists, the subject has been discussed at some length by John Sahlberg (1871 pp. 19-23) and O. M. Reuter (1875).

The North American and Australian forms have as yet been too slightly investigated; nor am I aware of the exact proportions in the palaearctic forms, but Sahlberg states that 70 out of the 263 Scandinavian Leaf-hoppers (in 1870) are pterygo dimorphic, that is, more than one-fourth.

In most of the dimorphic Heteroptera (and in speaking now of the "poly-" or "dimorphism," I am alluding only to the poly- or dimorphism of the organs of flight) the thorax is somewhat profoundly modified, by the reduction of the organs of flight, owing doubtless to the degeneration of the supporting muscles. In the leaf-hoppers on the other hand there seems little difference in this respect, probably due to the fact that the thoracic muscles are already somewhat feeble and little adapted for strong flight.

In polymorphism there are two well marked forms, the extremes, that is, of *macropterism* and *brachypterism*, as well as numerous *intermediate* forms sometimes.

In older times, it was supposed that the brachypterous (or apterous) forms were sexually immature, and later, when macropterous and apterous forms were observed in copulation, it was supposed that they were nymphs capable of procreation. These apterous or brachypterous forms have been reared from ordinary nymphs and are completely mature as regards their sexual apparatus.

The genus *Perkinsiella* affords a good example. There are 4 known species, closely allied but abundantly distinct. Two occur in Australia (one also in Hawaii) one in Viti, one in Java: the first three have been abundantly investigated by Koebele and Perkins, the fourth by Breddin.

(1) *saccharicida* Kirkaldy: the males always macropterous, the female is di- (or more or less poly-) morphic.

(2) *graminicida* Kirkaldy: as far as known the male is always macropterous, the female brachypterous.

(3) *vitiensis* Kirkaldy: both sexes are dimorphic pterygially.

(4) *vastatrix* Breddin: similar to *vitiensis*.

It has been supposed by Flor and Sahlberg that this polymorphism is caused by climatic influence. These authors believe that this inability to develop properly the tegmina and wings, does not exist embryonically in the egg, but depends on accidental conditions, such as the nourishment of the nymphs, and above all on the state of the climate during their development. Sahlberg adds that the feeble development of the organs of flight is altogether due to the greater development of the other organs of motion, i. e., the legs. Reuter believes, however, that the increase in number of polymorphic species as one proceeds northwards in Europe depends probably on many other causes, independent of climatic influence. Thus only eight species of Auchenorhynchi live in Lapland on trees or bushes, and these species are always monomorphic.

Reuter makes the following observations:

(1) Dimorphic forms are found even in the tropics.

(2) Short-winged individuals are observed most frequently among insects whose legs are well developed and constructed

for leaping or running very quickly; thus dimorphism is strongly represented among Orthoptera and Auchenorhynchous Siphonata; and indeed in the Miridae, the great part of the dimorphic species have thickened posterior legs, as is also the case with the femora in the Anthocoridae.

(3) There are a great number of instances where the female alone is dimorphic, but never a one where the male alone is so. In such cases the female very often has the femora more thickened than are those of the male—[among Heteropterous Miridae.]

(4) Most dimorphic species live on herbs or near the roots of such like.

(5) On the contrary, no dimorphic species live on trees or bushes.

(6) In some cases, dimorphism depends so obviously on the manner of living of the species that it cannot be caused by the climate, for example, in certain Myrmecophilous species.

(7) Not a single dimorphic species has been found among the numerous fossil Orthoptera and Hemiptera.

Reuter therefore concludes:

(1) The macropterous is the primitive form and the brachypterous forms are only produced in a more advanced period by "natural selection"; the existence of a macropterous form of a species usually brachypterous must be regarded as *reversion.*

(2) The reduction of the flight-organs is probably produced by diverse causes; in certain Myrmecophanous Miridae, it evidently depends on the manner of living of the species and "mimicry"; the Anthocorid *Myrmedobia coleoptrata* mimics *Alexia pilifera*, a little Coleopteron. [It should be noted however that many Formicicolous insects do not at all resemble their hosts or jailors.]

(3) Many species have lived in localities where they have not been obliged to resort to flight, because instead of trees and bushes they have lived on the ground or among herbs, thus using their legs more often. Consequently in successive generations, the latter are continually developed more strongly, while the muscles of flight by lack of usage are generally enfeebled and atrophied, the tegmina and wings thus becoming as much shortened as the legs are developed and thickened, by the law of "reciprocal influence."

(4) The male, as the active sex, has been obliged to avail himself of his organs of flight, and exercise his muscles; this is why this sex, in many species, has, by heredity, the tegmina and

wings developed, while the female is dimorphic and rarely macropterous.

Reuter divides polymorphic forms into two kinds—I reproduce his classification, but not his polysyllabic nomenclature:

(1 and 2) Trimorphic and dimorphic forms, the latter subdivided into

(a) Female only dimorphic, e. g. *Perkinsiella saccharicida.*

(aa) Both sexes dimorphic, divided into

(b) Male dimorphic in a different manner to the female, e. g. *Euidella speciosa.*

(bb) Sexes equally dimorphic, e. g. *Peregrinus maidis.*

Reuter further divides the forms according to degree of shortening, as follows:

(1) Brachypterous form has the tegmina either a little shorter than, the same length as, or a little longer than, the abdomen, and the apical cells most often moderately developed.

(2) Tegmina at least a third shorter than the abdomen, and much shorter than those of the macropterpus forms; apical cells short, obsolescent, or absent; wings rudimentary or wanting. This section contains the majority of forms.

The term brachypterous ranges through "*micropterous*" from "*brachypterous*" to "*apterous.*"

In comment on the above, it may be noted—

(1) That in the tropics there are certainly many dimorphic leaf-hoppers arboreal.

(2) There seems to be no difference, in leaf-hoppers, in the structure of the legs in different forms of the same species.

(3) Th effect of climate is very problematical, but it is likely that in the tropics, brachypterous forms appear in the colder season. As Perkins has well remarked:

"One point in connection with this flightless forms is worthy of notice. Although the insect has not been with us for study for a sufficiently long time for us to speak with certainty on the point, yet, so far, the worst attacks of leaf-hopper have always followed or been partly coincident with the production of these flightless females, that is to say during the colder months of the year, or in the early summer. In the course of my recent tour of investigation through Hamakua to Olaa, I did not find a single example of the short-winged form, while in the winter months from some plantations not less than fifty per cent of the adults sent were of this form. This fact and some observations that I have made on other Hawaiian species, lead me to believe that the flightless leaf-hoppers are more prolific than the fully winged specimens."

In connection with this, it is worth noting that both in *Perkinsiella saccharicida* and *graminicida* e. g., the brachypterous females have distinctly larger and fatter abdomens which appear at least to contain many more ova.

(c) MATERNAL AFFECTION.

The maternal solicitude, which has rendered so celebrated certain Earwigs, Centipedes, Cimicidae, and other Arthropods, finds expression also in a Membracid, *Entylia sinuata,* the details of which have been related by Miss Murtfeldt. The remarkable point is that the hopper, usually so shy, leaping away at the first alarm, refused to move when touched, while guarding her offspring.

(d) STRIDULATION.

The Stridulation of the Cicadoidea was known to the Greeks, and doubtless was investigated by many a philosopher before Xenarchos. The other Auchenorhynchi have always been supposed to be silent; but *Perkinsiella saccharicida* has been distinctly, and often, heard to stridulate by the Entomologists of this station, though specially modified organs have not yet been discovered. As the tegmina, even in the brachypterous forms, are observed synchronously to jerk up and down, this may have some connection with the phenomenon.

(e) THE RELATIONS BETWEEN LEAF-HOPPERS AND ANTS.

The relations between ants and other insects are extremely complicated and little understood.

That herds of Aphidae are kept in temperate zones by ants, and tended in the most remarkable manner, is too well known to be further dwelt upon; in the tropics, where as a rule Aphidae are very rare, their place is taken by other insects, among them certain Coccidae (i. e., Mealybugs), Leaf-hoppers, etc. Spix and Martius, Beske, Lund, Hardwicke, Guilding, Swainson and Belt have recorded observations on this point, though they were doubted by Sharp. Green however, has recently reobserved the phenomenon in Ceylon. He says: "I have frequently watched the larvae of various species of *Centrotus* being assiduously attended by ants. The larvae are gregarious, usually frequenting the succulent shoots of plants, and have an extensile organ at the extremity of the body, from which the coveted fluid is emitted. This organ is distinctly 3-segmented. The small terminal segment was of a crimson color; the penultmate segment black, with a broad white median band; and the basal segment (of the extensile part) white. When the insect is undisturbed this organ is withdrawn into the long conical segment which apparently terminates the body, but is extruded immediately upon application by the attendant ants."

Green calls this form a *Centrotus*, Buckton naming it *C. nectaris* but apparently it does not belong to that genus.

In Hawaii, although ants often kill considerable numbers of young *Perkinsiella*, on the other hand they appear to protect them from their enemies, at a later stage, so that they (the ants) can enjoy the honey dew excreted from the hoppers.

It may be noted that Goding states that species of *Tragopa* (a Membracid) live in the ground in the nests of the ants, while a curious new ~~Jassin~~e, (*Myrmecophyrne formiceticola*) was discovered under a stone in an ants' nest by Mr. Perkins. Further, it has been known, and occasionally noted, that the remarkable Tetigoniophanous Fulgoroid *Tetigometra laeta* is found in similar situations to *Tragopa*.

Tetigoniine

SYSTEMATIC POSITION AND CLASSIFICATION OF LEAF-HOPPERS.

(a) SURVEY OF PREVIOUS SYSTEMS.

"Leaf-hopper" is a convenient, non-technical term to express the Auchenorhynchi, excluding the Cicadidae.*

As regards the structure of the mouth parts the components of the order Hemiptera (or Rhynchota) are perhaps the most isolated of true insects; they form two sub-orders, viz.: the *Heteroptera* (or "bugs" proper), and the *Siphonata* (or Homoptera), the latter embracing two well marked groups, *Auchenorhynchi* and *Sternorhynchi*, based on the method of articulation of the labium.

The former contains Cicadids and Leaf-hoppers; the latter, Lerpinsects, Plantlice, Scalebugs, etc. The Cicadidae are not included in the general term "Leaf-hoppers" and will not be noticed except for purposes of comparison, the Australian forms having recently been monographed by Goding and Froggatt.

The first systematic disposition of any noteworthiness was that of Stal (1858, Stettiner Ent. Zeit., XIX, 233), in which he recognizes 5 families, Fulgorina, Cercopina, Cicadina, Membracina and Jassina, differentiated as follows:

1. Middle coxae elongate, articulated remote from each other. Tegmina with tegulae......................(1) *Fulgorina.*

1a. Middle coxae, short, conical, approximate. Tegulae absent.. 2.

2. Posterior coxae short, conical, not laterally dilated; tibiae cylindric.. 3.

2a. Posterior coxae transverse, dilated up to the lateral marmargins of the sterna; tibiae (at least the posterior pair) angled. (4 and 5) *Membracina & Jassina*, distinguished by the generally relative difference in the shape of the genae, and the spinoseness of the femora, also the attachment of the head onto the prothorax, etc.

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* The Chermoidea (Psyllidae) are "leaf-hoppers" in a sense, but belong to another group (Sternorhynchi), and are sometimes called popularly "Jumping Plant Lice."

3. Anterior femora unarmed, not thickened; scutellum moderate or small; an arolium (*empodium*) between the claws; 2 ocelli. ....(2) *Cercopina.*

3b. Anterior femora thickened, spinose beneath; scutellum very large; 3 ocelli; no arolia...............(3) *Cicadina.*

In 1866 Stal. reduced this to 4 families only, Stridulantia Cercopida, Jassida and Fulgorida. His three subfamilies of Cercopida are those recognized by later authors, but are not natural; his Jassida form 7 subfamilies of which 6 are Membracine while his Fulgorida are divided into 13 subfamilies.

I reproduce (translated) Stal's tables of Fulgoridae in their entirety, as I shall refer to them later in some detail.

I. Anal area of wings reticulate; keel separating frons from gena continued onto the sides of the clypeus. *Fulgorida* Stal.

II. Anal area very rarely reticulate, clypeus in this case convex, lacking lateral keels.

A. Posterior tibiae lacking an apical, mobile spur.

a. Frons wide, transverse or almost as long as wide, produced on each side into a distinct angle; anterior legs compressed, more or less dilated; anal area of wings sometimes reticulate. ....*Eurybrachydida* Stal.

aa. Lateral margins of the frons not angulate; legs mostly simple; anal area of wings never reticulate.

b. Clavus very rarely granulate, apex acuminate, rarely somewhat obtuse, distinctly closed, the two veins united far (or very far) from the apex (sometimes nevertheless after the middle) of the clavus; costa very rarely dilated; tegmina sometimes abbreviate or the clavus and corium fused.

c. Vena clavi (anal vein) not reaching the apex, running into the comissure near the apex; tegmina sometimes abbreviate or the clavus and corium fused, lateral margins of clypeus in this case keeled.

d. Frontal ocellus absent, lateral margins of clypeus always keeled or acute......................*Dictyophorida* Stal.

dd. Ocelli always three, one at the apex of the frons; frontal ocellus very rarely lacking, in this case the sides of the clypeus are convex, wanting a keel..........*Cixiida* Stal.

cc. Vena clavi continued to the very apex of the clavus or united near the apex with the claval suture; tegmina sometimes abbreviate or lacking veins or the clavus and corium fused, lateral margins of the clypeus in this case not carinate.

1. Head narrower than pronotum; sides of the clypeus keeled; last segment of rostrum elongate; pronotum angulately emarginate at the base; tegmina internally widened beyond the clavus; first segment of posterior tarsi elongate...... .... *Achilida* Stal.
2. Head narrower than pronotum; sides of the clypeus not carinate or with an obtuse keel; pronotum most usually angulately emarginate at the base, very rarely roundly sinuate, tricarinate, lateral keels diverging, most often reaching the base; commissure straight or rounded after the clavus, costa sometimes dilated, costal membrane transversely veined; first segment of posterior tarsi elongate... .... *Tropiduchida* Stal.
3. Head most often narrower than the pronotum; sides of the clypeus sometimes carinate; rostrum with the last segment short or very short; pronotum posteriorly angulately emarginate, not keeled or with one obsolescent one; costa simple; posterior tibiae most often unarmed, rarely spinose; first segment of posterior tarsi elongate. *Derbida* Stal.
4. Head narrower than pronotum, sides of clypeus keeled; rostrum short, thick, last segment very short; pronotum truncate basally, disk carinate or tuberculate; first segment of posterior tarsi strong, less long. . *Lophophida* Stal.
5. Head not or little narrower than pronotum; clypeus most often convex, lateral margins very rarely with a keel, pronotum truncate basally, rarely widely roundly sinuate, without a median keel or with an obsolescent one; scutellum short, rarely twice as long as the pronotum; tegmina coriaceous or subcorneous, rarely vitreous, very rarely flat, more or less convex, sometimes very much abbreviated; first segment of posterior tarsi short or mediocre, very rarely elongate............................. *Issida* Stal.
6. Head wide or very wide, sometimes somewhat narrower than the pronotum; sides of the pronotum most often lacking a keel; pronotum posteriorly roundly sinuate, lacking keels or with an obsolescent median one; scutellum very large, costa dilated, costal membrane transversely veined or reticulate; posterior tibiae spinose; first segment of posterior tarsi short or rather short........... *Ricaniida* Stal.
7. Head a little narrower than pronotum; clypeus lacking lateral keels; pronotum subtruncate at the base or lightly and widely roundly-sinuate, not keeled or obsolescently so; scutellum large, at least three times as long as pronotum; tegmina very greatly decumbent; posterior tibiae spineless. .... *Acanoniida* Stal.

bb. Clavus strewn with granules, apex sometimes subacute and closed, sometimes very obtuse and widely open, the two veins separated throughout their entire length or united near the apex; costa dilated, costal membrane transversely veined; claval suture distinct................*Flatida* Stal.

B. Posterior tibiae with a mobile spur at the apex.......... .... *Delphacida* Stal.

The Cercopidae are divided by him as follows:

I. Anterior margin of pronotum straight; eyes equally long and wide...............................*Cercopida* Stal.

II. Anterior margin of pronotum rounded or angled; eyes most often transverse.

A. Scutellum flat, triangular.............*Aphrophorida* Stal.

B. Scutellum strongly elevated, compressed posteriorly, armed with a long apical spine.............*Machaerotida* Stal.

The Tetigoniidae were studied only very superficially by Stal.

In 1875 was commenced the posthumous publication of Fieber's "Cicadines d'Europe." In an analytical table he divided the European Auchenorhynchi into 8 families, Membracida, Cicadaea, Fulgorida, Cercopida, Ulopida, Paropida, Scarida and Jassida, the last four being part of the Jassida of other authors.

In 1888 Ashmead divided the Auchenorhynchi into 6 families: Cicadidae, Fulgoridae, Membracidae, Cercopidae, Bythoscopidae and Jassidae, and the next year separated the Fulgoridae into 6 subfamilies, Acanoniinae, Flatinae, Ricaniinae, Issinae, Caloscelinae, Dictiopharinae, the Cixiinae being further discerpted into Achilini, Tropiduchini, Derbini and Cixiini. This work was little more than a misleading adaptation of Stal, and was disfigured by many misprints in the rendering of previous generic names.

In 1890 appeared the most important work yet published on the classification of Homoptera; this was, however, presented in Danish and remained sealed to many workers till translated into English by the present writer (1903). Hansen founds his divisions on the characters especially of the antennae and legs, and recognizes four families, Stridulantia, Cercopidae, Jassidae (including Membracidae) and Fulgoridae. Hansen's table of families is now reproduced, from my translation, in its entirety and will be referred to in the course of this paper.

A. Second segment of peduncle of the antennae without sensory organs, flagellum with several or many foveae. Intermediate coxae with the intro-basal angles a little remote in ter se; coxal abduction somewhat small. Metasternum either entirely chitinous, or with two median sized membranous areas. Posterior coxae mobile, trochantins apparent; posterior trochanters a little or not wider than the femora; a flexion only possible between trochanter and femur; posterior femora without a "yellow spot" on the upper surface. Pleura of third to eighth abdominal segments entirely located on the lower side, formed of a larger exterior chitinous plate, and of an interior narrower area, partly membranous or evanescent. First pair of abdominal spiracles placed either laterally or ventrally. Third to eighth pairs placed ventrally, looking downwards. Tegulae always absent.

a. Three ocelli.

Flagellum consisting of five (or four?) elongate segments; sensory foveae very numerous in the two basal segments of the flagellum (some even found in the other segments. Conspicuous part of the mesonotum very large. Anterior femora very different from the intermediate pair (always considerably incrassate.) No empodium. Second pair of abdominal spiracles placed in a transverse ventral furrow, looking anteriorly and medianly; third to seventh pairs placed in the sternites, not in the pleura. Stridular organ present in the male. Antennae always placed in deep pits in front of the eyes under the anterior margin of the vertex. Tegmina unarmed beneath. Anterior margin of the wings a little curved towards the base, unarmed. Metasternum entirely chitinous. Posterior scarcely wider than the intermediate coxae, never reaching to the lateral margin of the thorax. Posterior femora simple, posterior tibiae cylindrical. . ...1. *Stridulantia* (i. e. *Cicadidae*).

b. Ocelli two or none. Flagellum composed of either numerous segments, or of an inflated basal segment and a very slender "seta"; some sensory foveae present, never numerous. Conspicuous part of the mesonotum median-sized, or small or absent. Anterior femora scarcely different from the second pair (most often not incrassate.) A large empodium present. Second pair of abdominal spiracles placed laterally, looking exteriorly or partly upwards. Third to eighth pairs placed in the pleura. No stridular organ.

a. Flagellum composed of a large subpyriform basal segment, and a very slender "seta"—generally subarticulate; basal segment with some sensory organs, "seta" without them. Tegmina with a carina towards the base on the lower surface. Anterior margin of wings towards the base with a triangular plate, which is furnished on the exterior margin with some hooks. Me tasternum somewhat long, with two medium sized membranous areas. Posterior coxae scarcely wider than the intermediate pair, not reaching to the lateral margin of the thorax.

Posterior femora towards the base on the upper surface with a wider transverse keel. Empodium thicker, beneath with two chitinous spinose strips, the free margin a little or scarcely emarginate. Eyes always placed on the vertex towards the base. Antennae always placed in deeper pits in front of the eyes under the anterior margin of the vertex. Intermediate coxae with a strong meracanthus. Posterior tibiate cylindrical, each with a single process, or with two conical larger processes on the outer surface..............................2. *Cercopidae.*

b. Flagellum always composed of numerous segments; basal part longer, formed either of some (2-6) segments, or transversely furcate furnished with some scattered sensory pits; distal part divided into many segments, at least in part. Tegmina beneath not carinate. Anterior margin of the wings without a triangular plate, sometimes somewhat convex. Metasternum short, entirely chitinous. Posterior coxae much wider than the intermediate pair, extending as far as to the lateral margin of the thorax. Posterior femora simple at the base. Empodium thinner beneath, without apparent chitinous spines; free margin profoundly incised medianly. Ocelli sometimes on the vertex, sometimes on the front, occasionally evanescent. Antennae usually inserted in front of the eyes, sometimes under the eyes Intermediate coxae somewhat rarely with a meracanthus. Posterior tibiae very often prismatic or foliaceous, very rarely almost cylindrical, generally seriately spinulose, very rarely unarmed. ....3. *Jassidae.*

B. Second segment of the peduncle with many or very many peculiar (composite) sensory organs; flagellum with a single larger sensory organ on the pyriform basal segment. Intermediate coxae with the intero-basal angles considerably or very distant inter se; coxal abduction well developed. Metasternum almost entirely membranous, and this thin cuticle is extended outwards to the lateral parts of the metatharox, which is inflected somewhat on the lower side of the body. Posterior coxae immobile, their exterior part coalesced with the metathorax; trochantins absent. Trochanters very much stouter than the posterior femora; both an abduction and flexion possible between trochanter and femur. Posterior femora with a "yellow spot" near the base on the upper surface. Pleura of the third to eighth segments largely or altogether situated laterally, either altogether membranous, or with a large upper area in large part or altogether membranous, and a lower plate chitinous. First pair of abdominal spiracles situated dorsally within the exterior produced part of the metanotum. Third to eighth pairs situated essentially laterally, and in large part or altogether turning outwards.

Ocelli more rarely evanescent, more often two at the sides of the head in front of the antennae; sometimes a third ocellus is found on the lower margin of the front near the base of the clypeus.

Antennae inserted under the eyes; flagellum composed of a thicker basal segment and a very slender "seta," either articulate or altogether divided into numerous segments. Tegula almost always present. Empodium coalesced with the claws throughout a shorter distance, and at most through two-thirds of a length of the claws; free margin a little emarginate or simple. Second pair of abdominal spiracles dorsal, somewhat remote from the lateral margin........................4. *Fulgoridae.*

Two years later, Van Duzee considered that the North American Cicadina were composed of nine families, Cicadidae, Membracidae, Fulgoridae, Cercopidae, Ulopidae, Ledridae, Bythoscopidae, Tettigonidae and Jassidae, the last five being collected into a super-family, Jassoidea. The Tettigonidae were divided into Tettigonina and Gyponina; the Jassidae into Acocephalina, Jassina (Dorydini, Deltocephalini, Athysanini, Jassini and Cicadulini) and Typhlocybina.

I shall refer later, to Van Duzee's classification of the Jassoidea, so that I now reproduce the characters for reference. It should however be noted, in fairness to Van Duzee, that he expressly restricts his classification to the North American Fauna: at the same time, the main points of his scheme are largely in use.

Superfamily *Jassoidea.*

"Ocelli on the face below the anterior edge of the head. ....Family *Bythoscopidae.*
Ocelli on the disc of the vertex..........Family *Tettigonidae.*
Ocelli on or near the anterior edge of the head, or wanting. ....Family *Jassidae.*

Family *Tettigonidae.*

Front large, prominent, strongly convex, cheeks long and narrow, anterior edge of the head obtuse, or rounded. ....Subfamily *Tettigonida* Berg.

Front flat, or slightly convex; more or less impressed across the base beneath the prominent and acute, or rounded and overhanging anterior edge of the head; cheeks at least moderately expanded..........Subfamily *Gyponina* Stal.

Family *Jassidae*.

Ocelli placed superiorly close to the anterior edge of the head. ....Subfamily *Acocephalina*.

Ocelli on the anterior edge of the head, or wanting......(a.)

a. First sector of the elytra forked near its base, the inner branch generally united to the second sector by one or two transverse nervures, usually one or both branches of the first sector are again forked, forming two or three antiapical areoles; supernumerary cell present in the wings; ocelli present.........................Subfamily *Jassina*.

First sector of the elytra forked close to its base, thus forming apparently three sectors, which run straight and undivided to the angular nervures separating the four apical areoles; no transverse nervures between the first and second sectors; wings without a supernumerary cell; ocelli usually wanting..........................Subfamily *Typhlocybina*.

Tribes of the *Jassina*.

Anterior edge of the head thing and sharp, or more or less foliaceous. .... *Dorydini*.

Anterior edge of the head sometimes acute, but generally obtuse or rounded, never thin and foliaceous..........(a.)

a. Elytra with two transverse nervures between the first and second sectors of the corium...............*Deltocephalini*.

Elytra with but one transverse nervure between the first and second sectors of the corium....................(b).

b. Elytra without a series of antiapical areoles, or with but one formed by the forking of the outer branch of the first sector, vertex subquadrate, hind and lateral margins elevated, before feebly arcuated, with the edge strongly rounded, or produced and tumid before with an obtuse apex. ....*Jassini*.

Elytra with a series (generally three) of antiapical areoles.(c.)

c. Outer branch of the first sector of the elytra with two forks evident.................................*Thysanini*.

Outer branch of the first sector of the elytra with its outer fork obsolete, or nearly so; anterior edge of the head well rounded, vertex but little if at all longer on the middle than next the eye................................*Cicadulini*.

In 1895 Osborn announced his views on the Phylogeny of the Auchenorhynchi as follows:

"The other division (i. e. Auchenorhynchi) beginning with those forms which have the most generalized condition of wing venation and body structure, would commence with the Cicadidae and follow the ascending order which is given in the current systems. It is true that the Cicadidae are themselves a specialized group, particularly in the forms possessing musical organs, but in their approach to the Psyllidae in wing venation and structure of the head and thorax they seem on the whole to present more generalized characters than can be found in any of the other families of the Homoptera.

"The Membracidae, except in extremely specialized pronotum, are easily seen to be related to the Cicadidae and naturally take their position next to them. The Fulgoridae, while possessing specializations of the head, are in thoracic structure and venation more generalized than the remaining families, and while possessing many highly differentiated sub-groups, may very probably be interposed between the preceding families and the Jassoid division. The Cercopidae in development of scutellum and in texture of elytra, as well as in the specialization of the tibiae, show characters of rather high rank, and, if placed as subordinate to the Jassoidea, they must at least be considered as a branch of nearly equal or parallel rank. The Jassoidea, separable into Bythoscopidae and Jassidae proper, may, on the whole, be considered as the most highly organized of the series, and as somewhat equivalent branches, the Bythoscopidae being in some respects extremely specialized, while the Jassidae are subdivided into nearly equal branches, Jassinae and Tettigoninae."

(b) SYSTEM ADOPTED.

The following is the classification I adopt here for the Auchenorhynchi, showing also their position with regard to other Hemiptera, proceeding from the more primitive to the more specialized.

Group 1—*AUCHENORHYNCHI* Amyot & Serville.

Super-family 1—*CICADOIDEA.*

Family 1—CICADIDAE.

Super-family 2—*TETIGONIOIDEA.*

Family 1—TETIGONIIDAE (=super-family Jassoidea, Van Duzee.)

Sub-family 1—Tetigoniinae.
2—Iassinae.
3—Agalliinae.
4—Penthimiinae.
5—Eupteryginae.
6—Ledrinae.
7—Stenocotinae.
8—Kahavaluinae.
(9—Megophthalminae (?).)

Family 2—MEMBRACIDAE.
3—CERCOPIDAE.

Super-family 3—*FULGOROIDEA.*

Family 1—FULGORIDAE.

Sub-family 1—Cixiinae.
2—Dictyophorinae.
3—Fulgorinae.

Family 2—ASIRACIDAE (=subfam. Delphacida Stal.)
3—ACHILIDAE.
4—EUTROPISTIDAE (=Tropiduchida Stal.)
5—DERBIDAE.
6—LOPHOPIDAE.
7—ISSIDAE.

Sub-family 1—Issinae.
2—Eurybrachyinae.
3—Tetigometrinae.

Family 8—POEKILLOPTERIDAE.

Sub-family 1—Ricaniinae.
2—Poekillopterinae. (=Flatida Stal.)
3—Amphiscepinae (=Acanaloniida Stal.)

(Families 3-6 are probably conventional, as will be discussed later.)

Group 2—*STERNORHYNCHI* Am. & Serv.

Super-family 1—*CHERMOIDEA.*
2—*APHOIDEA.*
3—*ALEYRODOIDEA.*
4—*COCCOIDEA.*

The principal points that (largely following Hansen and opposing Osborn, Van Duzee and others) I wish to insist upon very firmly, are:

1. The low estate of the Cicadoidea *as a whole.*

2. The slight degree of specialization of the Tetigonioidea in almost every point.

3. The Membracidae are only Tetigonioidea, highly specialized as to the pronotum.

4. The high degree of specialization of the Fulgoroidea and their great differentiation in every way from the other superfamilies.

I especially mark the last heading, as Osborn, in particular, who has so extended a knowledge of the Homoptera, emphatically places the typical Tetigonioidea at the head of the Auchenorhynchi.

(c) THE OUTER FRAMEWORK OF LEAF-HOPPERS.

Before proceeding further with this inquiry, I propose to discuss some part of the outer framework of the leaf-hoppers, and I make no apology for doing this at some length because firstly, almost every second author uses a different horismology, and secondly, the only comparatively recent discussions (I have not taken into consideration Spinola's extensive "Essay on the Fulgoridae" which was published 66 years ago) on the value, for taxonomic purposes, as a whole, of various organs in the Homoptera, are those of Hansen and Osborn, the latter also being only too brief.

In Leaf-hoppers, the head appears to be composed of 2 main sclerites, the *epicranium* and the *clypeus*; at one time I thought it possible that the '*frons*' of authors might be really the clypeus of other orders, the '*clypeus*' really the labrum and the '*labrum*' really the *epipharynx*, but the fact that in typical Cixiinae, there is an ocellus at the apex of the 'frons' seems to dispose of this at once, at least no one has ever supposed that there could be an ocellus on the clypeus. The structure of the head-capsule (*epicranium*) is, and has always so far proved, enigmatical and very little help in its elucidation is obtainable from text books The horismology of Hemipterists is certainly not homologous with that of workers in other orders. In Fulgoroidea there are usually considered to be 3 conventional areas, viz: Vertex, frons and genae; (lorae and tempora being added in Tetigonioidea.) In other insects the vertex is that part of the head which is bounded anteriorly by an imaginary line when the insect is in a horizontal situation, the frons being the remainder, mediolongitudinally, as far as the clypeus; thus the extent of the vertex is purely conventional and depends upon the degree of declivity of the head. In the Auchenorhynchi, the head is always more or less declivous and bent under; and *at*, or *near*, the angulation or midst of the rounding, there is almost always a transverse keel, or false suture; or on either side of an imaginary line, the quality of the sculpturing is different, so that as a rule it is practicable to consider that there are 2 nameable and distinguishable areas, which are called '*vertex*' and '*frons*', not, however, strictly homologous to the 'vertex' and 'frons' in other orders, though, like them, strictly terms of convenience and not designations of separate sclerites; that they really are one sclerite may, apart from embryological evidence, be inferred from the position of the ocelli,—in many Tetigonioidea the 2 ocelli are close to the base of the vertex—while in some Fulgoroidea, two are on the genae, an extra ocellus being present right on the apical margin of the frons.

It follows, therefore, that the vertex may be partly ventral, or contrariwise the frons may be partly dorsal. The first contingency occurs among the Agalliinae, where the ocelli are often found far on the ventral aspect of the head; the latter occurs in certain Fulgoroidea, in which the vertex is very short, (in many Fulgoroids in which the vertex and frons are confused, I suspect that the former is entirely absent, as in some, it is represented merely by a linear section,) and apparently also in some Cercopids. Van Duzee uses the term "face" to designate the ventral aspect of the head, including the ventral part of vertex, the frons, genae, etc. Stal occasionally seems to follow the practice of workers in other orders, but this author rarely explained his horismology and is frequently very obscure. Edwards distinguishes a 'forehead' between the crown (vertex) and face.

The frons is rarely anastomosed with the clypeus. Sometimes it is so, discally, being sometimes then sutured off laterally.

The genae are the lateral parts of the head, sometimes placed actually laterally (*Fulgoroidea*) or ventrolaterally (*Tetigonioidea*), and are usually separated from the frons and vertex by keels or false sutures. Owing to the peculiar structure of the head in the Fulgoroidea the tempora do not seem to be separable; in the Tetigonioidea they are usually seen as narrow strips extending from the antennal scrobes to the posterior margin of the front, sometimes onto the lateral parts of the vertex; they are very conspicuous in *Tartessus*. The lorae are two small plates usually more or less crescentiform, lying between the clypeus and the genae, separable from them by false sutures and present only in the Tetigonioidea; they correspond with the juga in certain Heteroptera. In the Cercopidae there is often a falsely-sutured-off antero-median piece (resembling somewhat in *appearance* the Heteropterous *tylus*) which coalesces posteriorly with the disk of the vertex and anteriorly fuses more or less with the frons, though usually separated by a keel; whether this is really part of the vertex or is a part of the frons pushed up, is uncertain. In some Fulgoroidea (most Cixiinae) there are 3 ocelli, two in the usual Fulgoroid position (i. e. at the more or less flat sides of the head, close to the antennae) and one at the anterior margin of the frons, adjoining the clypeus. In the Tetigonioidea they may be almost anywhere on the vertex, sometimes close to the base. (Tetigoniinae etc.), sometimes near, or on, the anterior margin of the head (Iassinae etc.), sometimes again at the extreme apical margin of the vertex, close to the frons (Agalliinae.) In Stenocotinae & Kahavaluinae, they are situated at the bottom of elongate furrows on, or near, the anterior margin of the vertex. Often they are obviously functionless, though rudimentarily present, rarely entirely wanting. The work of the ocelli is enigmatical. In the Fulgoroidea, their position is practically uniform, though their usefulness must be sadly circumscribed by the surrounding elevated keels. It is evident that in the Tetigonioidea the position of the ocelli is of great importance for systematic purposes—for it is obvious that the directions and extent over which an insect can see, must influence its life very greatly. It is unnecessary to dwell on this subject, but it is evident that the visuality or light perception or whatever their use may be, must be very different in *Tetigonia* where the ocelli are placed on the disk of the vertex, near the base and turning a little outwards, to *Agallia* where they are far on the disk of the face; and sufficiently different in *Phrymomorphus* where they are small and flattish and placed on the smooth anterior margin of the vertex, to *Aphrodes* where they are near the anterior margin (but on the disk,) this genus being carinate anteriorly, the disk being a little sunk.

In his celebrated studies, Hansen has laid great stress, and rightly so, on the form of the antennae and on the structure of their sensory organs. I much regret that I have not had sufficient time to continue Hansen's researches very far, but I have done so sufficiently to convince myself of their great value. Their characteristics in the various super-families etc. are sufficiently displayed in Hansen's table, quoted previously.

Of the Thorax I need not speak, except to point out that while usually of ordinary structure in the Tetigonioidea (with the exception of the remarkable Membracidae,) the pronotum is considerably modified in the Derbidae, and in very many Fulgoroidea is arched or rounded strongly anteriorly and most frequently more or less deeply emarginate posteriorly. The scutellum is nearly always 1-5 carinate in the Fulgoroidea, rarely carinaté in the Tetigoniidae and Cercopidae. It should be noted that by "thorax," Stal means "pronotum" only.

In certain forms of Derbidae (*Philadelphia* etc.,) in which the flight organs are very peculiar, the scutellum has lost its characteristic triangular shape, with sharply limited margins and has more the appearance of that sclerite in the Cicadoidea.

It is so difficult to be sure of seeing correctly the empodia of the tarsi, that I have omitted any notice of them.

The venation in Siphonata is very difficult to homologize with other orders; it can at least be done only by embryological studies. At the present time, the nomenclatures of Stal, Fieber, Edwards, Westwood, etc., are used somewhat indiscriminately and loosely. I have collated these and other systems as far as feasible (being guided largely by Comstock & Needham) and have drawn diagrams to show the venation of various types. In *Scolypopa australis*, a Fulgoroid of the subfamily Ricaniinae there are 8 veins given off by, or near, the basal cell of the corium, 5 from the apical margin (Nos. 3 to 7) and 3 from the base, or near it (Nos. 1, 2 and 8). In order they are costal, subcostal, radial, subradial, median, submedian, cubital, sutural. In the clavus there are two, viz.: anal and axillary. In most forms the subradial and submedian appear only as forkings of the radial and median.

The costal vein, *as a rule*, is present only near the base and is lost later on in the subcostal which is usually, except near the base, the marginal vein; in such a case the costal is usually not on a plane with the rest of the tegmen. In the Poekillopteridae and a few others, the costal vein is complete, though sometimes subobsolescent as a thick vein. In the Cicadoidea, the subcostal and radial (and largely the obsolescent costal) are fused more or less.

The three main veins proceeding from the apical margin of the basal cell appear always to be (from the exterior inwards), radial, median, cubital. These three are almost always easily recognizable, though in most Tetigonioids and Asiracids the first two have a somewhat long common stem, the medioradial; on the other hand, in Ricaniinae we have 5 veins, here adding a subradial and a submedian. The sutural vein appears sometimes on one side, sometimes on the other, of the claval suture and is of little account.

Synonymy of Venation in Tegmina of Leaf-hoppers.

1. *Costal.*
2. *Subcostal*=radius *Spinola*=costa (p) *of many authors.*
3. *Radial*=cubitus *Spinola*=mediastinal *Westwood.* =Upper branch of cubital *Sahlberg*=1st. sector *Fieber.*
4. *Subradial*, usually present as a fork of the radial, or entirely absent.
5. *Median*=1st. discodal *Spinola*=postcostal *Westwood.* =exterior branch of exterior ulnar *Stal.*=lower branch of cubital *Sahlberg*=2nd. sector *Fieber.*
6. *Submedian*=interior branch of exterior ulnar *Stal.*; usually present as a fork of the median.
7. *Cubital*=2nd. discoidal *Spinola*=median *Westwood.* =interior ulnar *Stal.*=3rd. sector *Fieber.* =brachial *Edwards.*
8. *Sutural*=postcubital *Spinola*=anal *Westwood*=1st. anal *C. & N.*
9. *Anal*=claval *Stal.*=2nd. anal *C. & N.*
10. *Axillary*=3rd. anal.

Cells (or Areas) of Tegmina.

1. *Costal* (often absent=costal membrane *Stal.*
b. *Subcostal*=costal cell Stal (p). In some forms where the costal vein is rudimentary, this is often termed the costal cell.
c. *Radial*=subcostal *Melichar, Edwards,* etc.
d. *Subradial.*
e. *Median*=basal *Edwards.*
f. *Submedian.*
g. *Cubital*=brachial *Edwards.*
h. *Basal* cell.

The marginal cells from the apex of the subcostal to the apex of the clavus, are called "apical cells"; basal of these to the basal cell, between the subcostal and the cubital, are the "discoidals," some of which may be "subapical" (or "anteapical").

Wings.

The relations of the wing-veins and cells are very obscure and they have been little used in classification, except as regards the presence of the submarginal vein and the supernumerary cell.

Four types are figured somewhat diagrammatically, viz., Tetigoniine, Eupterygine, Agalliine and Asiracid.

(1) *Costal*, absent or merged.
(2) *Subcostal.*
(3) *Radial*=first sector *Fieber*=costal *Signoret.*
(4) *Median*=second sector *Fieber* =upper radial *Signoret..*
(5) *Cubital*=third sector *Fieber*=lower radial *Signoret..*
(6) *First anal*=Radiating nerves *Fieber.*
(7) *Second anal.* "

[The Claval suture (pliant suture *Fieber*) usually comes here.]

(8) *Axillary*, or third anal=Claval.
(9) *Submarginal*=peripheric nervure *Fieber.*

The only cell necessary to specify is

(a) *Supernumerary cell*, often absent; it is formed by the forking of the radial.

It is unnecessary to dilate on the legs. As the popular name implies, they are saltatorial in construction, and so great is the velocity of the leap in some forms (*Oncometopia* and other Tetigoniinae) that they have gained the name of "Sharpshooters."

In the Asiracidae, one of the spines which fringe the apex of the tibiae, has in each posterior pair, become greatly enlarged, often enormously so, and mobile, being set with "teeth" on its outer edge; this is very characteristic of all instars. Curiously enough, the Asiracidae are by no means the champion jumpers, being surpassed both in length of leap and in velocity, by Tetigonioids and Fulgoroids of less leg development and destitute of a mobile spur.

It seems necessary to state that the "apex" or "apical margin" of any section, is that part of it farthest from the junction of thorax and abdomen; contrariwise, the "base" or "basalmargin" is the part nearest. Most authors erroneously speak of the basal angle of the scutellum as its apex; to avoid confusion, it is better to refer to it as the "posterior angle." Further, the part of the frons adjoining the clpeus is its apical margin and the top of the head is (typically) the base of the frons and apical margin of the vertex.

(d) CRITICISM OF PREVIOUS SYSTEMS.

After this short and very imperfect survey of the external structure and the life history of the leaf-hoppers, I propose to comment very briefly on the lines of classification laid down by the Masters in Hemiptera, cited near the beginning of this paper.

Unfortunately, owing to my almost entire lack of material for comparison,* I have been unable to accomplish much in the way of constructive criticism. These notes are solely intended to show how previous work must perhaps be modified in the light of this fresh material from countries so little known (as regards the Auchenorchynchi) as Eastern Australia and Viti.

And what an extraordinarily rich fauna of Leaf-hoppers there must be in Australia and the Southern Polynesian Islands! Messrs. Koebele and Perkins collected but a few months at the worst season of the year in the very places that an Entomologist, not collecting for such an economic purpose, would avoid on account of their barrenness.

Yet, these few months have produced nearly 500 species, almost all new. It is probably not too much to say that the Australian Region (in the widest extent of the name) is supporting today a leaf-hopper fauna of 10,000 species. It must be especially rich in Derbidae, Achilidae, Tetigoniidae, etc.

The region moreover demands the attention of Hemipterists, since it appears to possess the oldest existing fauna in the world. It is well known that the classification in all other orders of insects had to be considerably modified when the Australian fauna began to be worked out, and it will certainly be the case also with the Hemiptera. Goding and Froggatt have recently tackled the work in earnest, and it is to be hoped that extensive collections will be reaped before it is too late.

I must maintain the four leading points enunciated on p. 296 as being established by a study of the imago and of the nymphal instars in every detail of structure.

(1) The highly sensorized condition of the antennae in the adult and of almost the whole body of the nymphal instars, the presence of tegulae, the remarkable carination of the head and nota, and the disposition of the parts of the former, the richly

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* I am indebted to my colleague, Mr. O. H. Swezey, for allowing me access to his collections of Ohio Fulgoroids, and to my friend Mr. E. P. Van Duzee for several examples of Tetigonioid and Asiracid genera; to Mr. Ballou for *Stenocranus saccharivora ;* and to Dr. Melichar for a few Sinhalese forms; otherwise beyond my own collectings, I have been compelled to rely on the written word.

variegated and harmonious colouring in many instances, and the diversity of cephalic form, seem indubitably to point to the pre-eminence and isolation of the Fulgoroidea. It is also worthy of notice that (as pointed out in Part I of this Bulletin) their Dryinid parasites are of a higher estate than those of the Tetigonioidea.

(2) Contrariwise, the humble condition of the last named, proved by their imperfectly sensorized state, both in adults and nymphs; the absence of tegulae, the (usually) smooth, plebeian head of feeble differentiation, and the (usually) dull coloring. The only exceptions almost are the Membracidae, highly specialized and diversified in their prothoracic structure, nevertheless lowly as a whole; the often gaudily colored Cercopidae, which also have remarkable nymphal habits, and a few Tetigoniid forms such as *Stenocotis* and *Kahavalu.*

(3) The Cicadoidea, highly specialized in one direction, are as a whole very low.

(4) The Membracidae are fundamentally, as shown by Hansen, essentially Tetigonioid.

With regard to the subdivision of the families I regret that lack of time prevents my lingering long.

(1). *Stal's Classification of the Fulgoroidea.*

There is no doubt that Hansen's divisions by the characters of the antennae, are sound; at the same time, especially when dealing with novel uniques, it is often exceedingly difficult to determine just what is the form of the antennal sensory organs. I think the following are natural divisions:

(1) *Fulgoridae,* with subfamilies Fulgorinae, Dictyophorinae and Cixiinae, corresponding to Stal's Fulgorida, Dictyopharida and Cixiida; at the same time it is difficult to separate the last two, except by general facies.

(2) *Poekillopteridae,* with subfamilies Ricaniinae, Poekilopterinae and Amphiscepinae, corresponding to Stal's Ricaniida, Flatida and Acanoniida.

(3) *Issidae,* with subfamilies Issinae, Eurybrachyinae, and Tetigometrinae, corresponding to Stal's Issida and Eurybrachydida. Stal separates these widely, but I think their closely allied nature is established; the Issinae, via *Amphiscepa,* come very close to the Poekillopteridae. The Tetigometrinae should perhaps even form a family by themselves. They do not, I think, establish any link between the Fulgoroidea and Tetigonioidea, but, on the contrary, are very highly modified.

(4) We now have a heterogeneous mass, which I temporarily rank into families, viz., Achilidae, Eutropistidae, Derbidae and Lophopidae. These are almost certainly artificial. The character that separates them from the Fulgoridae is that the anal vein of the clavus runs into the commissure in the latter, while it runs into the apex of the clavus in the four families mentioned just before. This may seem a trivial character, but it was insisted upon by Stal, and is certainly correlated with other good characters; unfortunately in Achilidae and Eutropistidae, it is difficult to determine the character of the antennal sensory organs, though in some of the latter, they seem Fulgorid. Although laid down by Stal, he himself has erred in assigning certain genera correctly, as have Melichar and other authors, for instance *Lamenia* is certainly not a Derbid, though it might be an Achilid were it not for the claval venation. I have placed it temporarily in the Cixiinae, where it perhaps looks uncomfortable. Ashmead and Swezey locate it in the Poekillopterinae, but the clavus shows no trace of granulation and the venation is of a different type.

Many of the Eutropistidae have a close resemblance to Dictyophorinae but, as I believe, this is false. In the former, the costal vein is present in its entirety, and the costal cell is multivenose transversely; in the latter, the costal vein is short, merging in the subcostal, and the subcostal cell (which is the marginal) is plain.[*]

The Derbidae are most probably a mixture; the typical forms have a plain clavus, but the majority have the anal vein very strongly sensorized; here too are some of the most extraordinary antennae in the Homoptera.

The only conclusion to be gained from a consideration of the Australian Fulgoroidea is that they need a great deal more study, especially on the venation and antennae, and more especially on the earlier stages.

(2) *Van Duzee's classification of Tetigoniidae (his Jassoidea).*

(1) I do not think, after studying *Tartessus* and allied genera, that the "Bythoscopidae" really form even a subfamily; indeed it is very difficult to draw sharp lines of distinction all through

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[*] My recently published *Peggioga formosa* (the manuscript, however, finished in 1903) from Lefu, is stated to be allied to *Dictyophora*; it is, however, probably an Eutropistid. I have no specimens here for re-examination. *Astorga* also, although placed in the Dictyophorinae, has a well-developed costal vein.

the Tetigoniidae. The family seems discerptible somewhat on the following lines:

Iassinae Eupteryginae Stenocotinae
Penthimiinae Ledrinae
Tetigoniinae
Agalliinae

Kahavaluinae Ulopinae (? Membracidae)
? Megophthalminae

The Penthimiinae, Tetigoniinae, Agalliinae and Eupteryginae being all derived from Iassinae by various routes; Stenocotinae from the same via perhaps *Tartessus* or allied form; Ledrinae possibly from *Dorycephalus* or allied forms.*

Although convenient for grouping the North American forms, Van Duzee's results do not seem to me to be natural.

The most primitive known form would seem to be some ally of *Phrynomorphus*; from this there are many evident offshoots. For example through *Thamnotettix* we arrive at *Metriosteles* and its allies without any break, so that Van Duzee's "*Cicadulini*" are difficult to define sharply for a world fauna. The Eupterygine series would seem to be a logical continuation, the tegmina and wings being greatly and increasingly degraded; in all known forms but one, the radial, median, and cubital veins reach the apical cells without forking en route, and the venation is usually so degraded that it is difficult or impossible to trace the basal half of these veins at all. The discovery of *Ancono*, undoubtedly an Eupterygine, shows the more primitive forking of the medioradial (which unite again towards the apex) and displays the untenability of deriving the Eupteryginae from the Macrostelines.

The separation of the "Dorydini" is not I think scientific; elongation of the head springs up independently manywhere; for example *Phrynophyes* and *Giffardia* from *Phrynomorphus*; *Hecalus* and its allies from *Thomsonia* or allies; *Cephalelus* from near *Dorycephalus* which arises elsewhere.

The value of the transverse vein near the base of the tegmen between the radial and median veins was hotly criticized by Osborn and Ball, who denied it even specific value, but I have seen no public retraction by Van Duzee. The following groups seem more or less well circumscribed:

(1) *Iassinae*, corresponding to the Jassina of Van Duzee, a

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* It is possible, especially after a consideration of the nymphs, that the Stenocotinae are an offshoot from the Ledrinae.

huge heterogenous group, drifting into the Agalliinae via *Tartessus* and *Epithalamium*, and into the Tetigoniinae via *Macroceratogonia*.

(2) *Acocephalina* of Van Duzee (not the Acocephalidae of Edwards) should, I think, be included in the above; or if not, they would be separable* by the dorsal position of the ocelli, the degeneration of the organs of flight appearing of comparatively little account. *Eupelix* I would place here, but *Platymetopius* and its allies are certainly *Phrynomorphinc*.

(3) *Eupteryginae*, despite *Ancono*, are a well marked group.

(4) *Penthimiinae* (Gyponina of Van Duzee) have very little to do with the Tetigoniinae except that the ocelli are dorsal.

(5) *Tetigoniinae* correspond to the Tettigonida of Van Duzee; they probably include the curious *Macroceratogonia*.

(6) *Agalliinae* (Bythoscopida, Van Duzee) are difficult, as I have said before, to separate sharply from Iassinae.

(7) *Ledrinae* are well marked, but have something of the appearance of *Dorycephalus*, except that the ocelli are dorsal; *Ledra* is an extreme form.

(8) *Stenocotinae* are exclusively Australian, allied to Ledrinae but the ocelli are placed in separate grooves on the top of the rather thin head.

(9) *Kahavaluinae*, monotypical, strongly recalling certain membracine characters, ocelli placed somewhat as in Stenocotinae, but head not thin. Legs very feebly bristly.

(10) The *Megophthalminae* are possibly to be placed here.

(11) The *Ulopinae* are probably membracid.

(3) *Osborn's views on Phylogeny.*

I cannot conceive on what grounds the learned Professor considers the Tetigoniidae to be so highly organized. He instances the structure of the pronotum, head, scutellum and tibiae, etc., in the other families, but is silent as regards the special virtues of the Jassids.

To me the Tetigoniidae (and especially *Phrynomorphus*, *Deltocephalus*, etc.), seem far the most primitive of Leaf-hoppers. Their head, thorax, legs and genital segments seem to be of the most ordinary, common type that one could find in the larger orders of Insecta. The tegmina and wings are also very simple, though this is perhaps the simplicity of degradation.

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* Under the name of Aphrodinae.

The Membracidae are little related to the Cicadidae, except perhaps more or less superficially in venation and are closely allied to the Tetigoniidae in all essentials; they have however acquired a perpendicularly situated vertex and a remarkably specialized pronotum.

What Osborn means by special development of scutellum in Cercopidae, I do not know, as this is far more highly developed in size, presence of keels, etc., in many Fulgoroids. The Cercopidae are plainly Jassoids specialized in the direction of degradation of flight organs, etc., but with more complicated genitalia.

It is the Fulgoroids which are certainly far and away ahead of all the other Auchenorhynchi. In the adult state and far more so in the nymphal instars, the average Fulgoroid is a mass of sensory organs. The antennae are crowded with them (*Swezeyia* and *Phantasmatocera* in particular) and of very high degree of special organization. (In the other superfamilies they are sparse, minute, and of a simple character.)

The vertex in some adult forms (Achilidae, Derbidae, etc.), is throng with them (much more so in the nymphs). In the nymphs the nota are also crowded with them, and the tegmina in the adults, along the veins. Some Tetigonioids have granulate tegminal veins, but this is very common in, e. g., many Cixiinae in the Fulgoroids, while the anal vein of the clavus in most Derbidae is crowded with them. In Poekillopterinae, the clavus, on veins and in between, is throng, characteristically of the subfamily, with granulations, though these latter may not be sensory; in this subfamily, the tegmina are often very minutely and closely granulate in between the reticulations.

The pronotum, contrary to Osborn's opinion, is specialized in Achilidae, Derbidae, etc., in a way not reached even in *Stenocotis* among the Tetigoniidae. (Of course the Membracidae are excepted in this.)

In the other superfamilies, the head is of a most ordinary description, the ocelli placed, either dorsally or ventrally, somewhere on the vertex between the eyes; in the Stenocotinae and *Kahavalu*, they are in little grooves on the anterior margin of the head. In the Fulgoroidea the head is almost always remarkably keeled, there seeming in some forms to be a keel wherever one can be placed; the side of the head is flattened and it is there that the ocelli are placed, close to the eyes and antennae. Finally, the genitalia are very much the most specialized in the Fulgoroidea.

In the discussion on Osborn's paper, Ashmead briefly presented his views; he is certainly more correct in his order of Cicadidae, Jassidae, Membracidae, Fulgoridae (he omits Cercopidae), but he derives these from the Sternorhynchi, believing that the Coccidae are the lowest, root-stock!

(4) *Summary.*

(1) The Fulgoroidea are enormously the most specialized, highly organized and differentiated, of the Auchenorhynchi, the Cixiinae possibly being the most primitive types, though in some respects the Derbidae are:

(2) The most primitive existing forms of Siphonata seem to be the Cicadoidea, but

(3) The Tetigonioidea seem to have arisen separately.

(4) Of the Tetigonioidea the *Phrynomorphus* forms seem to be the most generalized; Agalliinae are specialized a little in the extreme declivity of the vertex and frons, and ventral position of the ocelli; they also tend to spinoseness of the tibiae, culminating in the Cercopiform Eurymelini.

(5) The Membracidae are highly specialized in the pronotum, but are otherwise very low.

(6) The Cercopidae are perhaps as a whole the culmination of the Tetigoniioidea.

LIST OF NEW GENERA AND SPECIES COLLECTED BY KOEBELE AND PERKINS IN QUEENSLAND, NEW SOUTH WALES AND VITI.

Fam. Tetigoniidae. (Australian Species.)

1. *Tetigonia koebelei* sp. nov.
2. *T. pasiphae* sp. nov.
3. *T. parthaon* sp. nov.
4. *T. pettimolua* sp. nov.
5. *T. anemolua* sp. nov.
6. *Macroceratogonia* gen. nov., *aurea* sp. nov.
7. *Thaira* gen. nov., *labena* sp. nov.
8. *Phrynomorphus longuinquus* sp. nov.
9. *P. taedius* sp. nov.
10. *P. fatigandus* sp. nov.
11. *Phrynophyes* gen. nov., *phrynophyes* sp. nov.
12. *P. parvula* sp. nov.
13. *Anemolua* gen. nov., *hanuala* sp. nov.
14. *Anemochrea* gen nov., *mitis* sp. nov.
15. *Deltocephalus* (?) *perparvus* sp. nov
16. *Nephotettix plebeius* sp. nov.
17. *N. contemptus* sp. nov
18. *Scaphoideus pristidens* sp. nov.
19. *Euleimonios* gen. nov., *demittendus* sp. nov.
20. *Kosmiopelex* gen. nov., *varicolor* sp. nov.
21. *Dryadomorpha* gen. nov., *pallida* sp. nov.
22. *Giffardia* gen. nov., *dolichocephala* sp. nov.
23. *Hecalus immaculatus* sp. nov.
24. *Paradorydium menalus* sp. nov.
25. *P. pseudolyricen* sp. nov.
26. *Dorycephalus ianthe* sp. nov.
27. *D. subreticulatus* sp. nov.
28 *D. trilineatus* sp nov.
29. *Tartessus syrtidis* sp. nov.
29a. *Myrmecophryne* gen. nov., *formiceticola* sp. nov.
30. *Pettya* gen. nov., *anemolua* sp. nov.
31. *Nesosteles* gen. nov., *glauca* sp. nov.

32. *N. sanguinescens* sp. nov.
33. *N.sordidior* sp. nov.
34. *N. taedia* sp. nov.
35. *Thaumatoscopus* gen. nov. *galeatus* sp. nov.
36. *Vulturnus* gen. nov., *vulturnus* sp. noc.
37. *Ectopiocephalus* gen. nov., *vanduzeei* sp. nov.
38. *Epipsychidion* gen. nov., *epipyropis* sp. nov.
39. *Eurinoscopus* gen. nov., *lentiginosus* sp. nov.
40. *E. sontiates* sp. nov.
41. *E. soboles* sp. nov.
42. *E. dryas* sp. nov
43. *E. pelias* sp. nov.
44. *E. molestia* sp. nov.
45. *E. pelamys* sp. nov.
46. *Pedioscopus* gen. nov., *philenor* sp. nov.
47. *P. polydoros* sp. nov.
48. *P. agenor* sp. nov.
49. *Ipo* gen. nov., *ambita* sp. nov.
50. *I. conferta* sp. nov.
51. *I. honiala* sp. nov.
52. *I. aegrota* sp. nov.
53. *Idiocerus ipo* sp. nov.
54. *Eurymeloides hyacinthus* sp. nov.
55. *E. cumulosus* sp. nov.
56. *E. bicinctellus* sp. nov.
57. *E. ornatus* sp. nov.
58. *E. rubrivenosus* sp. nov.
59. *E. lentiginosus* sp. nov.
60. *Eurymela rubrolimbata* sp. nov.
61. *E. plebeia* sp. nov.
62. *E.lubra* sp. nov.
63. *Aneono* gen. nov., *pulcherrima* sp. nov.
64. *Kahaono* gen. nov., *hamuala* sp. nov.
65. *Dikraneura* gen. nov., *honiala* sp. nov.
66. *D. aneala* sp. nov.
67. *Cicadula histrionicula* sp. nov.
68. *Eupteryx haematoptilus* sp. nov.
69. *Empoa australensis* sp. nov.
70. *Erythroneura melanogaster* sp. nov.
71. *E. lubra* sp. nov.
72. *E. honiloa* sp. nov.
73. *E. ipoloa* sp. nov.
74. *E. honiala* sp. nov.
75. *Rhotidus ingens* sp. nov.

76. *R. informis* sp. nov.
77. *R. flavomaculatus* sp. nov.
78. *R. monstrum* sp. nov.
79. *R. ledropsiformis* sp. nov.
80. *R. horrendus* sp. nov.
81. *R. viridescens* sp. nov.
82. *Smicrocotis* gen. nov., *obscura* sp. nov.
83. *Kyphocotis* gen. nov., *tessellata* sp. nov.
84. *Kahavalu* gen. nov., *gemma* sp. nov.

(Vitian Species.)

85. *Nesosteles* gen. nov., *hebe* sp. nov.
86. *Cicadula vitiensis* sp. nov.

Fam. Membracidae (Australian).

87. *Gelastorrhachis* gen. nov., *diadema* sp. nov.
88. *G. clavata* sp. nov.
89. *Sarantus nobilis* sp. nov.
90. *Sextius assimilis* sp. nov.
91. *S. longinotum* sp. nov.
92. *S. kurandae* sp. nov.
93. *Acanthuchus dromedarius* sp. nov.
94. *A. obtusus* sp. nov.
95. *Centrotypus hospes* sp. nov.

Fam. Cercopidae (Australian).

96. *Euryaulax* gen. nov., *callitettigoides* sp. nov.
97. *Aufidellus* gen. nov., *australensis* sp. nov.
98. *Aufiterna* gen. nov., *ptycloides* sp. nov.
99. *Petyllis* gen. nov., *australensis* sp. nov.
100. *Eurycercopis* gen. nov., *nigrofasciata* sp. nov.
101. *Polychaetophyes* gen. nov., *serpulidia* sp. nov.
102. *P. aequalior* sp. nov.
103. *Pectinariophyes* gen. nov., *pectinaria* sp. nov.
104. *Anyllis* gen. nov., *leiala* sp. nov.

Fam. Fulgoridae (Australian).

105. *Eurystheus perkinsi* sp. nov.
106. *Eurinopsyche* gen. nov., (type *obscurata* Fabr.)
107. *Thanatodictya* gen. nov., (type *praeferrata* Distant).

108. *Lucinda* subgen. nov., *lucindae* sp. nov.
109. *Niculda* subgen. nov., *anadyomene* sp. nov.
110. *T.* (*N.*) *hebe* sp. nov.
111. *T.* (*N.*) *psyche* sp. nov.
112. *Hasta* gen. nov., *hastata* sp. nov.
113. *H. paupera* sp. nov.
114. *Astorga* gen. nov., *saccharicida* sp. nov.
115. *Solonaima* gen. nov., *solonaima* sp. nov.
116. *Oliarus laertes* sp. nov.
117. *O. kampaspe* sp. nov.
118. *O. taluna* sp. nov.
119. *O. asaica* sp. nov.
120. *O. felis* sp. nov.
121. *O. alexanor* sp. nov.
122. *O. lubra* sp. nov.
123. *O. sponsa* sp. nov.
124. *O. phelia* sp. nov.
125. *Carolus* gen. nov., *crispus* sp. nov.
126. *Gelastocephalus* gen. nov., *ornithoides* sp. nov.
127. *Calamister* gen. nov., *obscurus* sp. nov.
128. *Lamenia kulia* sp. nov.
129. *L. hiva* sp. nov.
130. *Perkinsiella graminicida* sp. nov.
131. *Phacalastor* gen. nov., *pseudomaidis* sp. nov. (and Viti.)
132. *P. koebelei* sp. nov.
133. *Stenocranus agamopsyche* sp. nov.
134. *Hadeodelphax* gen. nov., *pluto* sp. nov.
135. *Gelastodelphax* gen. nov., *histrionicus* sp. nvo.
136. *Smicrotatodelphax* gen. nov., *perkinsi* sp. nov.
137. *Ectopiopterygodelphax* gen. nov., *eximius* sp. nov.

(Vitian species.)

138. *Perkinsiella vitiensis* sp. nov.

(See also No. 131.)

Fam. Eutropistidae (Australian).

139. *Ossa venusta* sp. nov.
140. *O. formosa* sp. nov.
141. *Peltodictya* gen. nov., *kurandae* sp. nov.
142. *Rhinodictya* gen. nov., *quaesitrix* sp. nov.

(Vitian).

143. *Vanua* gen. nov., *vitiensis* sp. nov.

Fam. Achilidae (Australian).

144. *Aristyllis* gen. nov., *aristyllis* sp. nov.
145. *A. omphale* sp. nov.
146. *A. adippe* sp. nov.
147. *Benella* gen. nov., *aliena* sp. nov.
148. *Pyrrhyllis* gen. nov., *pyrrhyllis* sp. nov.
149. *Majella* gen. nov., *majella* sp. nov.
150. *Phenelia* gen. nov., *elidipteroides* sp. nov.
151. *Eurynomeus* gen. nov., *australiae* sp. nov.
152. *Argeleusa* gen. nov., *kurandae* sp. nov.
153. *Cythna* gen. nov., *laon* sp. nov.
154. *Salemina* gen. nov., *francescophila*, sp. nov.
155. *Francesca* gen. nov., *Saleminophila* sp. nov.
156. *Ancipo* gen. nov., *diva* sp. nov.

Fam. Derbidae (Australian.)

157. *Nisia grandiceps* sp. nov.
158. *Phaconeura froggatti* sp. nov.
159. *P. pallida* sp. nov.
160. *Basileocephalus* gen. nov., *thaumatonotus* sp. nov.
161. *Thyrocephalus* gen. nov., *leucopterus* sp. nov.
162. *Phantasmatocera* gen. nov., *arborea* sp. nov.
163. *Heronax* gen. nov., *parnassius* sp. nov.
164. *H. saccharivora* sp. nov.
165. *Philadelpheia* gen. nov., *pandani* sp. nov.
166. *Sardis* gen. nov., (type *maculosa*.)
167. *Kaha* gen. nov., *perfecta* sp .nov.
168. *Rhotana chrysonoe* sp. nov.
169. *R. haematoneura* sp. nov.

(Vitian.)

170. *Suva* gen. nov., *koebelei* sp. nov.
171. *Phaciocephalus* gen. nov., *vitiensis* sp. nov.
172. *Swezeyia* gen. nov., *lyricen* sp. nov.
173. *Phantasmatocera* gen. nov., *vitiensis* sp. nov.
174. *Levu* gen. nov., *vitiensis* sp. nov.
175. *Pyrrhoneura* gen. nov., *saccharicida* sp. nov.

Fam. Issidae (Australian.)

176. *Issus vulturnus* sp. nov.
177. *I. sidnicus* sp. nov.

178. *I. ridicularius* sp. nov.
179. *I. elongatulus* sp. nov.
180. *Lollius* gen nov., *angustifrons* sp. nov.
181. *L. acutipennis* sp. nov.
182. *Sarnus lucindae* sp. nov.
183. *Lipocallia* gen. nov., *australensis* sp. nov.
184. *Gelastissus* gen. nov, *albolineatus* sp. nov.
185. *G. histrionicus* sp. nov.
186. *G. suffusus* sp. nov.
187. *Platybrachys oculata* sp. nov.
188. *P. chlorocephala* sp. nov.
189. *Olonia picea* sp. nov.
190. *Dardus immaculatus* sp. nov.
191. *Euronotobrachys* gen. nov., *arcuata* sp. nov.
192. *E. plana* sp. nov.
193. *Gelastopsis* gen. nov., *insignis* sp. nov.

Fam. Poekillopteridae (Australian.)

194. *Siphanta galeata* sp. nov.
195. *S. acutipennis* sp. nov.
196. *S. breviceps* sp. nov.
197. *S. toga* sp. nov.
198. *S. lucindae* sp. nov.
199. *S. subgranulosa* sp. nov.
200. *S. granulata* sp. nov.
201. *S. sidnica* sp. nov.
202. *Euryphantia* gen. nov., *cinerascens* sp. nov.
203. *Sephena rubida* sp. nov.
204. *S. hyacintha* sp. nov.
205. *S. cinerea* sp. nov.
206. *S. argus* sp. nov.
207. *Jamella* gen. nov., *australiae* sp. nov.
208. *Massila walkeri* sp. nov.
209. *M. sidnica* sp. nov.
210. *Mimophantia australensis* sp. nov.
211. *Aphanophantia* gen. nov., *cuscuticida* sp. nov.
212. *Scolypopa kurandae* sp. nov.
213. *Epithalamium* gen. nov., *aziola* sp. nov.

The following new specific names are also proposed incidentally:

Eupteryx melichari for *picta* Mel.
Aglena ornatula for *ornata* Walker.

LIST OF PREVIOUSLY KNOWN SPECIES COLLECTED BY KOEBELE AND PERKINS SO FAR AS WORKED OUT.

Family Tetigoniidae.

214. See 29a.
215. *Tetigonia albida* (Walker).
216. *Eutettix sellata* (Uhler).
217. *Nephotettix nigropicta* (Stal).
218. *Thomsonia arcuatus* (Motshulsky).
219. *T. lineolatus* (Motshulsky).
220. *T. kirschbaumii* (Stal).
221. *Cephalelus brunneus* (Waterhouse).
222. *Stenocotis planiuscula* (Stal).

Fam. Membracidae.

223. *Zanophara* (?) *tasmaniae* (Fairmaire).
224. *Z.* (?) *vitta* (Walker).
225. *Terentius convexus* (Stal).
226. *Dingkana borealis* (Goding).
227. *Sextius bipunctata* (Fabricius).
228. *S. virescens* (Fairmaire).

Fam. Cercopidae.

229. *Philagra parva* (Donovan).

Fam. Fulgoridae.

230. *Eurinopsyche obscurata* (Fabricius).
231. *Desudaba danae* (Gerstaecker).
232. *Thanatodictya praeferrata* (Distant).

Fam. Asiracidae.

233. *Perkinsiella saccharicida* Kirkaldy.
234. *Peregrinus maidis* (Ashmead).

Fam. Derbidae.

235. *Nisia atrovenosus* (Lethierry).
236. *Sardis maculosa* (Krueger).

Fam. Issidae.

237. *Platybrachys sicca* (Walker).
238. *Dardus abbreviata* (Guerin).

Fam. Poekillopteridae.

239. *Privesa aphrophoroides* (Walker).
240. *Scolypopa australis* (Walker).
241. *Gaetulia chrysopoides* (Walker).
242. *Neomelicharia furtiva* (Melichar).
243. *Siphanta acuta* (Walker).
244. *S. granulicollis* (Stal).
245. *Colgar peracuta* (Melichar).

DESCRIPTIONS OF GENERA AND SPECIES, ETC.

Of the localities investigated by Messrs. Koebele and Perkins, or otherwise referred to;

Cairns is on the coast of northeast Queensland, at the south end of Trinity Bay;

Redlynch, Nelson and *Kuranda* are more or less unimportant places nearby, the *Baron* River flowing into Trinity Bay a few miles north of Cairns;

Lucinda Point is some way to the south;

Bundaberg is near the coast opposite Great Sandy Island;

Brisbane and *Sydney* ,the capitals of Queensland and New South Wales respectively;

Parramatta, a western suburb of the latter, and *Mittagong*, an elevated town a little to the south;

Cape North is the most northern point of Queensland;

Palmerston is a coast district around Keppel Bay (or it may be the northwest district of Northern South Australia.)

Peak Down is an inland district between Drummond Range and Peak Range.

Rockhampton is near the coast at Keppel Bay.

Sandy Cape is the northern point of Great Sandy Island.

Gayndah is inland some distance about the same longitude as the south of Great Sandy Island.

(vi-xii)=June to December, 1904.

(i-iii)=January to March, 1905.

Family 1 Tetigoniidae.

Subfamily 1. Tetigoniinae.

Tribe 1 *Tetigoniini.*

This is equivalent to the Tetiigoniinae of most authors, some 40 genera are now recognized, but the limits of some of these are not sharply defined.

Elongate, head produced in front of the eyes (apically rounded or triangular, sometimes irregularly linear). Frons usually more or less convex, often much inflated; rarely flattened or even a trifle concave. Genae long and narrow between the eyes and the frons, broadening a little posteriorly. Clypeus broad, generally at least ⅔ of width of frons. Lorae small, laterally covered largely by clypeus. Rostrum short. Ocelli distinct, situated on the crown between the eyes below their anterior margin. Venation simple, often indistinct. In the type of the tribe, (the palaearctic *Tetigonia viridis* (Linn)) the two claval veins run separately into the commissure (aberrations occur); there are discoidal, 3 subapical, and 5 apical cell. A transverse vein stands on the cubital, varying in position a little even in the same individual, being sometimes basal of the median fork, sometimes apical. In many species of the typical genus this transverse vein is absent. Appendix present. In the wing there is no supernumerary cell. The other Tetigoniini do not differ greatly from this type, though sometimes the venation is more or less reticulate. Three Australian species have been described and I now add 6 more, all belonging to the typical genus:

Tetigonia Geoffroy.

Tetigonia Geoffroy, 1762, Hist. abregee Ins., I, 429. Kirkaldy, 1900, Entomologist, XXXIII, 262.

Tettigonia Latreille; Ball, 1903, Iowa Ac. Sci., 15-28, Pl. III-V, (nec Linn).

Cicadella Gray, 1832, Griffith's Anim. Kingdom, XV, 226.

Tettigoniella Jacobi, 1904, Zool. Jahrb. Syst., XIX, 778.

Antennal ledge small, scarcely visible dorsally. Head and pronotum horizontal, vertex produced before the eyes, usually obtusely rounded; frons swollen; Pronotum not twice as long as scutellum, posterior margin slightly emarginate. Tegmina broad, covering the tergites, not reticulate; with (usually) 5 discoidal (3 subapical) and 6 apical cells.

The headquarters of this cosmopolitan genus are in Central and South America.

The Australian species of *Tetigonia* are readily separable by color and size:

1. Length more than 15 mill..........7 *coerulescens* (Fabr.)
1a. Length under 15 mill..............................2
2. Ground color pale..............................3
2a. Ground color dark..............................7
3. Ground color distinctly yellowish....................4
3a. Ground color pale greenish-grey, or greyish-white, or pale cinereous. 6
4. Tegmina immaculate. 5
4a. Claval commissure blackish-brown....4 *parthaon* sp. nov.
5. Vertex 4 times as broad as long. (sec. Walker)...... ....8 *quadrata* (Walker)
5a. Vertex not more than one-half wider than long....... .. ..3 *pasiphae* sp. nov.
6. A central dark longitudinal stripe down the head, pronotum, scutellum and commissure..2 *perkinsi* sp. nov.
6a. Above mentioned stripe absent.......1 *albida* (Walker).
7. Black with orange red markings......6 *anemolua* sp. nov.
7a. Dark metallic bluish-green with ochraceous markings. ....5 *pettimolua* sp. nov.

N. B. 9 *albomarginata* (Sign.) not included.

1. *albida* (Walker.)

Tettigonia albida, Walker, 1851, List. Hom., 767, (nec. Walker, 777); Signoret, 1853, Ann. Soc. Ent., France, (3) I, 663, Pl. 21 f. 3; Melichar, 1903, Hom. Ceylon, 157 (*).

This species varies a little in size and pattern. One example in my collection, from Ceylon, has a typical right clavus, but in the left, the axillary vein joins the middle of the anal vein.

Hab: Queensland, Cairns (vii-viii), Nelson (vii) and Bundaberg (ix-xii) on sugar cane and various grasses; also occurs in Ceylon (my collection), Bombay (Melichar), Celebes (Breddin), Philippines (Stal), West and South Africa (Stal), and Madagascar (my collection).

koebelei, sp. nov.

Slender; pale testaceous; margin connecting vertex and frons ornamented with 3 ocellated spots (black, narrowly encircled with yellow). Vertex with a black median somewhat rounded stripe extending along pronotum, scutellum and claval commissure. Frons with a longitudinal submedian dark brown line on each side with downwardly curved subparallel transverse lines proceeding to the lateral margins, nearly reaching the genae. Clypeus with a longitudinal pale brownish line; lorae almost entirely pale brownish and there is a stripe of same color on genae. Ocelli redbrown. Mesonotum ornamented sublaterally with a black stripe (on each side) which shows faintly through the overlying pronotum. Underside stramineous. Posterior femora and tibiae longitudinally lined with blackish. Tegminal veins brown, basal half of cubital blackish, rather smudged.

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* This is not, as Melichar states (l. c.—) *pallida* Waiker 776, which on the contrary= *albida* Walker 777=*nigrifascia* Walker, an American speces. The Sicilian var. *pallida* Walker (781) of *Aglena ornata* requires a new name, for which I propose *ornatula*.

Shape of vertex not very dissimilar to that of *T. albida* but the eyes are larger and wider in proportion and the ocelli are smaller. Head and eyes distinctly wider than pronotum which is longer than the vertex. Clypeus somewhat angulate in profile. Frons moderately swollen. Pronotum finely striate transversely, anteriorly with an obtuse angular impressed line subparallel with the arched anterior margin. Tegmina with 5 discoidals (3 subapical) and 5 apical cells.

Length 6½ mill.

Hab: Queensland, Cairns (viii) only one female, unfortunately, of this distinct species.

3. *pasiphae* sp. nov.

Pale luteous; eyes, ocelli and 2 small spots near anterior margin of scutellum, blackish. Tegmina creamy yellow with darker veins; wings milky with pale yellowish veins. Ocelli pale greenishbrown. Leg hairs pale.

Vertex as long as or a trifle longer than the pronotum, rounded apically; frons swollen, flattened medianly. Clypeus subangulate. Pronotum punctured. Tegmina with 5 discoidal (3 subapical) and 5 apical cells.

Male unknown.

Female: last abdominal sternite slightly roundly emarginate, medianly truncate; pygofers about 4½ times as long as the last, narrowing posteriorly, sides not rounded posteriorly; in profile, apex narrowly rounded.

Female. Length 12¾ mill.

Hab: Queensland, Cairns (viii), arboreal.

In one specimen, the sternites are orange-yellow.

4. *parthaon*, sp. nov. (Pl. XXIII, fig. 1-3).

Same size and form as *T. pasiphae* but differently patterned, and frons a little more swollen.

Head, pronotum, scutellum, tegmina and underside pale yellowish, more or less tinged with orange. Eyes, 2 spots at base of pronotum, 2 at anterior margin of scutellum, claval commissure, etc., blackish. Ocelli pale greenish brown. Wings milky, veins more or less orange-yellow. Leg hairs pale. Abdomen orange. Membrane internally smoky.

Male: Last abdominal sternite truncate, plates a little more than twice as long as above; basal half broad, roundly narrowing, then more rapidly so towards the middle line of the abdomen, apices acute, fringed with soft hairs; pygofers much longer than plates.

Female: Pygofers longer and narrower than in *T. pasiphae*, about 3 times as long as last sternite, which is roundly emarginate; pygofers widen out a little before middle, then narrow rapidly; posteriorly narrowly truncate in profile

Length 10-10½ mill.

Hab: Queensland, Cairns (viii), Kuranda (viii), on *Saccharum officinale* and grasses.

The nymph of this form is figured on Pl. XXIII, fig. 3.

5. *pettimolua*, sp. nov.

Pale ochraceous, with the following markings blackish tinged more or less with metallic greenish or bluish—on the anterior margin of the head—3 rather blotchy spots, and 2 at the base; the lateral margins of the pronotum and 2 spots at the apical margin; at the base a blotch which is somewhat of the conventional figure of a bat with out-stretched wings, the "head" touching the intero-posterior angles of the anterior spots. Scutellum with 3 anterior spots. Frons with 2 submedian longitudinal stripes, sometimes meeting posteriorly; these are shortly pectinate, representing the usual striations on the *Tetigonia*-frons, but the lateral parts of the striations are pale ochraceous, concolorous with the ground color of the face. Tegmina dark metallic green, costal cell opaque whitish (or pale yellowish) narrowly bordered with black. Abdominal tergites mostly bluish-black. Anterior and intermediate tibiae and tarsi dark.

Male: Penultimate sternite roundly emarginate, ultimate truncate, plates formed much as in *T. parthaon* but about 3 times as long as last sternite, more elongate apically and there curving upwards (towards the dorsum), plentifully fringed with soft long white hairs.

Female: Last sternite roundly emarginate, laterally angulate, pygofers about $2\frac{3}{4}$ times as wide as the above, medianly swollen, apically roundly subtruncate in profile; furnished with short black hairs.

Length $6\frac{1}{2}$-7 mill.

Hab: New South Wales, Sydney (i-ii).

N. B. The dark colouring sometimes encroaches in a smudged manner more or less on the pale.

6. *anemolua*, sp. nov.

Basal half of vertex, pronotum, scutellum, tegmina etc., black, the latter more or less translucent apicoexteriorly. Apical half of vertex posterior margin very narrowly, a broad, slightly, arched transverse band across middle of pronotum (sometimes narower and interrupted in the middle, the clavus (except the interior area)—reddish castaneous or dark orange red. Underside pallid except the mesoternum. Abdominal tergites black.

Male: Sternites more or less (generally more) black. Pygofers rather short, rounded, acute apically, about $2\frac{1}{2}$ to 3 times as long as last sternite which is somewhat roundly emarginate.

Female: Sternites pallid except part of the ovipositor. Pygofers about 5 times as long as last sternite, an oblique keel on each side starting from exterobasal angle and meeting in the middle at a little more than one-third of the length; not rounded laterally, furnished with white hairs. Last segment truncate, slightly notched medianly.

Length $4\frac{1}{4}$-5 mill.

Hab: Queensland, Kuranda (viii), arboreal.

7. *coerulescens* (Fabricius.)

Cicada coerulescens Fabricius 1803 Syst. Rhyng. 74.
Aulacizes dives Walker 1851 List. Hom. 791.
Tettigonia caerulescens Signoret 672 Pl. 21, fig. 16.
Hab: Australia.

8. *quadrata* (Walker.)

Tettigonia quadrata Walker 1851 List. Hom. 781.
Hab: Tasmania.

9. *albomarginata* (Signoret.)

Tettigonia albomarginata Signoret 1853 Ann. Soc. Ent. France. (3) I, Pl. 10 fig. 4.

These three species are unknown to me, and I regret also that Signoret's descriptions remain unknown to me, as his 'Essai' was unpurchasable. The same author describes *Tettigonia varicolor,* 1852 op. c. II, 15, Pl. 1, fig. 15 from Honolulu, most probably in error, as no *Tetigonia* is now known here and a not inconsiderable part of Signoret's collection is notoriously labelled incorrectly.

Tribe 2 *Macroceratogoniini.*

Instituted for a single, new, genus *Macroceratogonia* which has the general facies of the first tribe and also of the third, but a very different head structure. The vertex is subhorizontal, flat, subquadrangularly produced before the eyes, wider apically than at the base; ocelli on the vertex anterior to the apical margin of the eyes. Antennal seta enormously long.

Macroceratogonia, gen. nov.

Pronotum, clavus, etc., finely punctured. Head slightly declivous; vertex at base less than ½ the width of pronotum apically; lateral margins keeled, diverging somewhat sinuately, the vertex being thus wider at apex than at base and nearly as long as wide; apical margin slightly rounded; basal ¾ narrowly sulcate, anterior fourth transversely somewhat sinuately impressed; immediately below the impression and a little nearer to the middle line than to the lateral margins are the conspicuous ocelli. The crown is separated from the frons by a narrow, well marked, continuous channel. The antennae are situated almost at the antero-lateral angles, first segment small, rounded bulbous, second small cylindric, seta enormously long, much longer than the entire body. Frons narrow, and curves from the insertion of the antennae; clypeus elongate, parallelsided: lorae curved exteriorly, not reaching the apical margin of the face, extending basally beyond the clypeus. Pronotum rounded anteriorly, lateral margins posteriorly divergent, posterolateral angles rounded, posterior margin subtruncate. Tegmina with 2 discoidal and 2 subapical cells, the exterior discoidal be ing undivided up to the apical cells. Appendix present. Wings with supernumerary cell. Legs typically Tetigonian.

14. *aurea*, sp. nov. (Pl. XXII, figs. 6-7.)

Pale golden yellow, tegminal appendix and underside paler. Eyes dark, and a small dark spot at base of appendix.

Length 9 mill.

Hab: Queensland, Kuranda (viii), arboreal.

Two females only. I would have included this remarkable genus in the Tetigoniini but it would have made too many exceptions in otherwise fairly sharply defined group-characters.

Subfam. 2. Iassinae.

Tribe 1. *Iassini*.

Vertex subquadrate, its sides and posterior margin elevated; frons elongate, narrow; clypeus wider posteriorly than at its base; ocelli on the curve of the head; usually only one subapical cell (but in *Tharra* Kirkaldy, the exterior discoidal is divided by a transverse vein thus forming another subapical); wings with a supernumerary cell. There are apparently 6 genera in this tribe viz: *Iassus* Fabricius (=*Coelidia* Germar and *Daridna* Walker), *Terulia* Stal, *Petalopoda* Spangberg, *Tinobregmus* Van Duzee, *Tharra* Kirkaldy and *Palicus* Stal; the latter, which is an African genus, I do not know; *Tharra* is Australian, the rest American.

Tharra, gen. nov.

Differs from *Iassus* Fabr. by the possession of 2 subapical cells and the absence of transverse veins in the clavus. From *Terulia* it differs by the subapical cells and by the straight anterior tibiae

Vertex flat, longer than wide, slightly declivious with regard to the pronotum, abruptly elevated at the lateral margins, the sides being at right angles to the disk,* which is very narrowly sulcate longitudinally up to the apical margin of the eyes and is produced a little, widened just apical to the eyes and rounded obtusely.

Eyes large, a little oblique; ocelli a little nearer to the lateral margins than the middle of the vertex. Frons elongate, narrow and gradually narrowing posteriorly. Clypeus quadrangular, a little longer than wide, distinctly wider at apex than at base; lorae small, not reaching to the apex of the face; genae narrow. Antennal seta long. Rostrum reaching to intermediate coxae, distinctly wider at the apex than at the base. Pronotum transverse, much wider than head and eyes, arched anteriorly, lateral margins rather short, posterior margin straight. Scutellum about as long as the pronotum. Clavus without transverse veins. Corium with 2 discoidal, 2 subapical and 5 apical cells. Anterior femora, anterior tibiae and intermediate femora subequal in length, slender, straight; intermediate tibiae about $\frac{1}{5}$ longer than anterior tibiae and about as long as posterior femora; posterior tibiae twice as long as intermediate tibiae; posterior femora reaching as far as, or beyond the apex of abdomen.

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* This is probably a tribal character, as stated above, but as Spangberg's figures do not show this clearly, I have mentioned it again in the generic characters.

1. *labena*, sp. nov.

Vertex sordid testaceous; frons blackish, rest of face, sterna, basal half of abdomen beneath, legs (except as undermentioned) etc., more or less pale luteous. Eyes, apical half of abdomen beneath, genital valve (female), apical half of posterior tibiae, posterior tarsi and all the claws, blackish. Pronotum and anterior half of scutellum sordid purplishbrown, posterior half of scutellum sordid yellowish. Tegmina yellowish translucent, veins crimson; an irregular spot at extreme base of corium, a spot near apex of costal cell, and about the apical half of each of the apical cells, etc., blackish. Wings dark smoky.

Female: Valve covered thickly with long, curling, rather coarse, white hairs.

Length $5\frac{1}{3}$ mill., width at base of pronotum $1\frac{1}{4}$ mill.

Hab: Queensland, Kuranda (viii), arboreal.

Unfortunately only one female of this interesting form. It has a distinctly Fulgorid look about it, and Mr. Perkins informs me that it also appears so in life.

Tribe 2. *Cephalelini.*

Phrynomorphus Curtis.

Phrynomorphus Curtis, 1833, Ent. Mag. I, 194.

Athysanus Burmeister, 1838, Gen. Ins. Jassus; Edwards, 1896, Hem. Hom. Brit. 136 Pl. II, fig. 10, etc.

This genus is extremely closely allied to *Deltocephalus*, the only difference I can find being that the vertex in the latter is usually more angulate and there are 5 discoidal cells instead of 4 as in *Phrynomorphus*, and in the latter there is usually only one transverse vein standing on the cubital.

The species are all obscure and of very ordinary appearance. I have indicated their uninteresting nature by the specific names bestowed on them.

1. *longuinquus* sp. nov.

Vertex broad, about as long as wide between the eyes, apically rounded (a little angularly, this being accentuated by the pattern), disk depressed in the middle. Frons broad, laterally rounded, apical margin slightly emarginate, about 3¼ times as wide between the eyes as at apex. Temples linear. Ocelli on a level with the disk of the vertex before the upper margin of the eyes. Clypeus wider than lorae, genae exterolaterally posteriorly strongly angulate. Pronotum short, more than twice as broad as long, lateral margins obsolescent, posterior margin truncate, posterolateral angles obsolete. Tegmina short, without appendix, not or scarcely reaching to apex of abdomen, 3 discoidals (2 subapical) and 5 minute apical cells. Pale cinereotestaceous, frons with close transverse dark lines radiating from each side of the central pallid line, continued a little over to the vertex, these latter being subconcentrically angulate(these lines are often more or less obsolescent.) Tegminal nervures a little paler than the ground colour, apically somewhat obscurely broken up by darker colour. Abdominal tergites more or less dark. Mesopleura with some more or less cloudy spots. Hairs on legs etc., black.

Male: 6th sternite obtusangularly emarginate, 7th slightly convex apically. Valves a little more than twice as long as 7th medianly, nearly as wide as long, lateral margins somewhat sinuate, posterior angle irregularly rounded.

Female: Pygofers brownish in the middle spotted with pallid. Little distinctive about them.

Length: 3¾ mill; width across eyes 1⅓-1½ mill.

Hab: New South Wales, Sydney (i-ii), Mittagong (i).

2. *taedius*, sp. nov.

Of similar size and general appearance to the preceding but differs as follows:

Vertex shorter than wide, slightly angulately rounded apically. Frons a little flatter, temples wider. Clypeus scarcely wider than lorae, genae less angulate. Pronotum with short but noticeable lateral margins. Coloring very similar but vertex, pronotum and scutellum with only obscure scattered pale-brown mottlings. Underside darker, anterior femora striped transversely with black. This seems to approach *Phlepsius* in some ways.

Length: 3¾ mill.

Hab: Queensland. Bundaberg (xi).

3. *fatigandus*, sp. nov.

Very similar specifically to *Phrynophyes indignus* but smaller and the frons immaculate, legs pallid. Vertex between the eyes about two-thirds of length of exterolateral margin of an eye.

Male: Propleura with black disk; lateral margins of sternites narrowly blackish; tergites pale organge-brown. Tegmina reaching beyond apex of abdomen.

Female: 7th sternite slightly emarginate, pygofers 4-5 times as long as seventh sternite, ovipositor one-third longer than pygofers, extending beyond apex of tegmina.

Length, male 4⅞; female 5⅛ mill.

Hab: Queensland, Cairns, Kuranda (viii) on grass.

Phrynophyes gen. nov.

Probably an offshoot from *Phrynomorphus*; it has much of the facies of *Lonatura*.

Head produced triangularly in front, longer than the width between the eyes, also a little wider between the eyes than the width of an eye. Eyes large, included in the curve of the head. Lateralmargins of pronotum short (but noticeable), not carinate. Tegmina abbreviated, venation somewhat obscure, 2 veins standing on cubital close together, rest of venation typically Phrynomorphoid, except that the clavus is reticulate. Type *P. phrynophyes*.

1. *phrynophyes*, sp. nov.

(Pl. XXIV, figs. 7-8.)

Pale cinereotestaceous (? metallic greenish grey when alive), frons pale brownish with somewhat feeble radiating lines from a wide, middle, immaculate area. Underside pale marked with brownish black. Veins of tegmina mostly whitish. Tergites laterally marked with black. Ocelli either absent, or present on one side. Frons convex basally, flattening gradually towards the truncate apex. Clypeus sub-parallelsided, broader than the lorae. Genae scarcely angular posteriorly. Pronotum shorter than the vertex. Tegmina with 3 or 4 discoidal, and 5 apical cells.

Female: 7th sternite very obtusangulately emarginate; pygofers long and narrow, 5 to 6 times as long as 7th sternite; ovipositor about one third longer than pygofers. Tegmina not nearly reaching apex of abdomen.

Length nearly 6 mill.

Hab: Queensland, Bundaberg, on grass (ix-xii); a specimen from Brisbane (xi) may be distinct.

2. *parvula*, sp. nov.

(Pl. XXII, figs. 1-3.)

When alive, metallic green, but fades after death to a shiny testaceous; tegmina and tergites more or less greyish metallic. Face pale sordid brownish, legs more or less marked with brown.

Female: elongate, tapering anteriorly and posteriorly. Vertex about 3 times as long as wide between the eyes, anteriorly acuminate, somewhat ascendant. Frons 5-hedral, long-diamond shaped, with a fifth side anteriorly, about as wide as clypeus, which is a trifle wider than the lorae; the latter do not quite reach the posterior margin of the genae. Tegmina very short, truncate. Ultimate segment roundly produced, pygofers elongate, narrow, largely exposing the very long ovipositor.

Length 6¼ mill; width about 1 mill.

Hab: Queensland, Bundaberg (ix-xii), on grasses.

There is also a single male from Bundaberg (xi) which probably belongs to this. Head acute anteriorly, more or less porrect, about one-half, or a little more, longer than wide between the eyes.

Length 4 mill.

Female nymphs are very similar to the adults.

I think it is this species that has been described by Buckton as a Membracid (!!) under the name of *Philya parvula* (1901 Mon. Membr. p. 57, Pl. 8, fig. 4.)

Anemolua gen. nov.

Vertex slightly convex and a little declivous; about one-half longer than wide between the eyes. Eyes large, each much wider than the vertex at the base, interolateral margin divergent towards the apex; vertex rounded in front of eyes, the latter forming part of the curve of the head. Vertex impressed at the base, sulculate mediolongitudinally. Frons elongate, about two thirds longer than wide at base, lateral margins somewhat straight, gradually narrowing towards the apical margin, which is scarcely wider than base of clypeus. Antennae elongate. Clypeus much longer than wide, widening slightly apically, lorae small, scarcely reaching further posteriorly than half the length of the clypeus; genae not angulate exterolaterally posteriorly. Pronotum slightly arched anteriorly, roundly emarginate posteriorly, lightly carinate longitudinally, lateral margins obsolescent. Scutellum shorter than wide. Tegmina reticulate, fundamentally 4 or 5 discoidals. Posterior legs elongate.

I placed this at first near *Iassus* and *Terulia* but the venation is very different, and the vertex is, if anything, *below* the dorsal level of the eyes.

1. *hamuala* sp. nov.

Testaceous; vertex with a black impressed spot near the base on each side of the sulculation.

Frons and clypeus pale brownish. Pleura and legs more or less blackish. Pronotum and scutellum marked with whitish. Tegmina brownish, veins and some blotches on costa etc. whitish; sometimes a blackish blotch near middle of tegmina.

Length $3\frac{3}{4}$-$5\frac{1}{8}$ mill.

Female: abdomen longer than tegmina; last segment roundly emarginate, pygofers about four times as long as the latter, ovipositor very long.

Hab: Queensland, Cairns (viii), arboreal.

Anemochrea gen. nov.

Closely allied to *Anemolua* but differs as follows:

Vertex almost as long in front of apical margin of eyes as behind, acuteangled apically; frons elongate suboval; Clypeus parallelsided. Lateral margins of pronotum short, but noticeable, not carinate, posterior margin truncate. Apical cells of tegmina strongly marked off, not reticulate. Venation of wings (which are very short) obscure.

1. *mitis* sp. nov.

(Pl. XXII, figs. 8-9.)

Dark brownish testaceous. Vertex blackish brown with two narrow transverse pallid lines, one midway between apex and apical margin of eyes and the other a little posterior to the apical margin of eyes. Face greyish, frons laterally with 8 or 9 somewhat remotely placed brownish transverse lines. Pleura and most of sternites (except genitalia) blackish. Tegmina with whitish veins, apical cells brownish-black posteriorly. Legs more or less pale brownish. Basal half of abdomen above, and a median line on rest of tergites, black.

Length 3-4½ mill.

Hab: New South Wales, Sydney (i-ii), Mittagong (i), Paramatta (i).

Var: Vertex somewhat pale; with apex, a bar between or above eyes, and a broken bar near base, blackish-brown.

The nymphs are not remarkable.

Deltocephalus Burmeister.

Deltocephalus Burm. 1838 Gen. Ins. Jassus subg. 3.

1. (?) *perparvus*, sp. nov.

Pale yellowish testaceous. Eyes blackish grey. A minute black spot at side of last tergite, and two almost contiguous black-brown spots on the preceding tergite. Sternites and pleurites spotted with blackish brown. Vertex distinctly longer medianly than at eyes, triangularly rounded in front, margin in front of eyes straight; vertex somewhat flat, a large rounded depression on each side of the middle line. Clypeus as wide anteriorly as frons posteriorly, which very gradually widens at clypeus, extending anteriorly beyond base of clypeus, posteriorly nearly touching margin of genae. Pronotum short, scarcely twice as broad as long, anteriorly arched, posteriorly slightly emarginate, sides very short. Tegmina short, reaching only to half the length of the abdomen, without appendix: venation very obscure, but I think there are five discoidals. Clavus nearly as large as the apically rounded corium. Wings minute.

Length 2⅓ mill.

Hab: New South Wales, Mittagong (i), Sydney (ii).

Eutettix Van Duzee.

Eutettix Van Duzee, 1892 Psyche, VI, 307; T. Amer. E. S., XIX, 300.

1. *sellata* (Uhler.)

Thamnotettix sellata Uhler, 1896, P. U. S. N. Mus., XIX, 294. *Eutettix sellatus* Matsumura, 1902, Termesz. fuzetek, XXV, 381, fig. 12; Melichar, 1903, Hom. Ceylon, 189.

Hab: Queensland, Kuranda (viii), Cairns (viii), Nelson (vii), Bundaberg, (ix-xii) on Sandhills, arboreal, (Koebele's No. 2299), also from Japan (Uhler), Ceylon (Kirkaldy), Papua, Java and Africa (Melichar), etc.

2 sp. nov.

Hab: Queensland, Cairns, Nelson, Bundaberg, on *Melaleuca*.

Nephotettix Matsumura·

Nephotettix Mats., 1902, Termesz. fuzetek, XXV, 356 and 378; Melichar, 1903, Hom. Ceylon 1902.

Melichar has confused *Selenocephalus cincticeps* Uhler from Japan (destructive to *Oryza sativa*) with a Sinhalese species which he identifies with *Pediopsis apicalis* and *P. nigromaculatus* Motshulsky. *N. apicatis* however differs from *cincticeps* as will be shown later, while a Madagascan species is closely allied also. I think that (*Cicada*) *bipunctata* Fabr. (=*Thamnotettix bipunctata* Stal) should replace the name *apicalis*, while (T) *nigropicta* Stal should replace *cincticeps Uhler*.

1. *plebeius* sp. nov·

Pale testaceous; a blackish transverse stripe on the vertex extending from eye to eye, immediately below the ocelli, not curving parallel with anterior margin but nearly straight across Frons pale testaceous from the base of the clypeus long-triangularly to base of frons; on each side of this to lateral margins of frons about 8 parallel, transverse blackish lines on each side (sutures of clypeus, etc., sometimes infuscate.) Pronotum subanteriorly with a somewhat feeble, arched, repeatedly broken blackish transverse line extending from side to side. Scutellum with usually 2 pale brownish specks about the middle. Tegmina hyaline pale cinereous, nervures brownish. Bristles on legs blackish brown.

Vertex twice as wide as long, rounded apically; frons broad, not widening from basal margin to antennal articulation, about two and a quarter times as wide as the base of the clypeus; clypeus a little broader than lorae; temples very narrow. Pronotum longer than the head, posterior margin truncate. First apical cell basally in a line with the base of the exterior subapical cell and much longer than it; second apical cell 5-hedral, sides more or less straight (except the apical margin).

Male valve about three-fourths of the length of the 7th. abdominal sternite (which is apically truncate) and about one-third of the length of the plates which are furnished with bristly hairs. Pygofers about the same length as, or a little longer than the plates, furnished with bristly hairs.

Female: 7th. sternite about twice as long as the 6th, longitudinally sulcate and apically notched in the middle to admit base of sawcase; pygofers about 4 times as long as 7th. sternite, furnished with granules which emit short bristly hairs; ovipositor longer than the pygofers.

Length (male) $4\frac{7}{8}$-$5\frac{1}{8}$ mill; (female) $5\frac{1}{3}$-$5\frac{7}{8}$ mill.

Hab: Queensland, Cairns (vii-viii), Bundaberg (ix-xii), Redlynch (vii), Lucinda Point (vii), on grasses; Koebele 2296 on sand-hills (ix), New South Wales, Sydney (i), Parramatta (i), probably introduced.

2. *contemptus* sp. nov.

Testaceous, the vertex with a curved blackish brown line anteriorly, parallel with the anterior margin; frons with a brownish black line close to basal margin and parallel with it; clypeus more or less brownish. Pronotum more or less clouded with greyish. Tegmina pale yellowish hyaline; apical veins brownish; wings smoky. Abdominal tergites more or less blackish on the disk, laterally more or less pallid.

Vertex a little more produced perhaps than in *plebeius*, frons narrowing suddenly soon after its basal margin as far as antennae, then narrowing gradually to clypeus, which is sublinear, much narrower than the lorae. First apical cell short, shorter than the 1st. subapical; second apical cell semi-circular.

Male unknown.

Female: 7th. sternite scutiform, carinate longitudinally, angularly rounded behind, the posterior angle very slightly produced again. Pygofers yellowish rufescent (with golden yellow hairs), shorter than the rufescent ovipositor.

Length: (female), 5¼ mill.

Hab: New South Wales, Sydney (i-ii).

A much slenderer species than *N. plebeius*, with different venation and different markings on the head.

3. *N. nigropicta* (Stal.)

Thamnotettix nigropicta Stal, 1871, O. V. A. F. 740.

Hab: Queensland, Cairns, on grasses. (Also from Philippines, China and Japan).

This species is closely allied to *N. bipunctata* (Fabr.)

Scaphoideus Uhler.

Scaphoideus Uhler, 1891 Trans., Maryland Ac. Sci. I, 33; Osborn, 1900, J. Cincinnati Soc., N. H., XIX 187.

Distributed through America, Japan and Oriental Region and I now describe a species from Australia.

1. *pristidens,* sp. nov.

Testaceous, more or less tinged with pink or yellow; vertex with two black spots at anterior margin and two irregular ochraceous brown spots just posterior. Frons anteriorly with about five transverse black lines (sometimes more or less interrupted). Pronotum more or less blotched laterally. Scutellum with two basal pinkish brown spots. There is a white median line from apical margin of vertex to posterior angle of scutellum. Tegminal picturation not cruciate, testaceous, veins brown, cells more or less fuscate; clavus with 3 large white spots contiguous to the commissure. Posterior legs and anterior and intermediate tibiae and tarsi spotted or ringed with black. Abdominal sternites more or less striped transversely with black. Vertex somewhat flat with a transverse impressed line; edges subacute; longer than wide, anteriorly triangular, acuteangled, lorae contiguous with posterior margin of genae.

Venation of corium very similar to that of *S. ochraceous* Osborn; outer claval vein hooked, and vein with a cross vein about its middle length.

Length: 4½-5½ mill.

Hab: Queensland, Cairns (viii).

N. B. The coloring and pattern is sometimes obscure.

The genus *Aphrodes* and its allies appear to be descended from some form very near *Phrynomorphus*, the ocelli being placed a little more dorsally and the tegmina being semicoriaceous and often much abbreviated, appendix always wanting; the wings have an incomplete submarginal vein. These characters which are simply due to the degradation of the flight organs and which may, and do, arise in any group of winged insects, have been used to form a family, viz.: Acocephalidae, though they are really scarcely sufficient to form a tribe.

Four genera showing these characters are known, viz.:

1. *Aphrodes* Curtis (=*Acucephalus* Germar=*Acocephalus* Burmeister=*Pholetaera* Zetterstedt=*Anoscopus* Kirschb).
2. *Stroggylocephalus* Flor (=*Strongylocephalus* Fieb).
3. *Kosmiopelex* Kirkaldy and
4. *Xestocephalus* Van Duzee, this last probably not really belonging here.

Kosmiopelex gen. nov.

Differs from *Aphrodes* by the differently shaped, foliaceous head, from *Eupelix* Germar by the eyes not being enclosed by the sides of the crown.

Head triangular, more or less porrect, specifically variable in this respect; foliaceous. Crown flattish, longer than wide between the eyes, from three to four times as long as pronotum. lateral margins in front of eyes slightly sinuate, apical fourth subspatulate. Frons oblongoval, twice as long as wide; genae at antennal sockets about three-fourths of the width of the clypeus which is parallel-sided, a little wider than lorae, the latter not quite touching posterior margin of genae. Eyes large, forming part of the curve of the head, not enclosed by lateral margin of crown. Ocelli on the disk of the crown just above anterior margin of the eyes, a little nearer lateral margins than the middle line. Pronotum transverse, about three times as wide as long, slightly arched anteriorly, very obtuseangularly emarginate posteriorly; lateral margins short. Tegmina coriaceous, abbreviated, reaching little beyond base of abdomen, posteriorly truncate, venation obscure; wings minute, venation obscure, submarginal vein absent. Legs normal.

1. *varicolor* sp. nov. (Pl. XXIII figs. 7-8.)

Typically: head, pronotum and scutellum pallid testaceous, marked with brownish black. Tegmina shining blackish brown, posterior margin widely milky white. Abdominal tergites shining blackish brown, except the white genital segment. Legs black and white, more or less mottled.

The species varies considerably in color and pattern, however, like its congeners, independent of sex. The general color may be pale testaceous, abdominal tergites pale yellowish brown, no clear markings, or in the other direction, like the type, but pronotum milk white and a milk white band across.

Length: 2⅞-3½ mill.

Hab: Queensland, Bundaberg (ix-xii).

There is nothing notable about the nymph.

Dryadomorpha, gen. nov.

Superfically somewhat like *Cephalius*, but the ocelli are frontal and the face is shaped differently etc. Vertex acutely produced in front of the eyes, a little longer than wide at the base, slightly concave, basal half sulcate longitudinally; longitudinally finely striate; anterior margin of head acute. A sensory depression close to each eye near the base. Eyes large, not forming part of the curve of the head. Ocelli very small, immediately in front of the acute margin of the head, nearly midway between eye and apex of vertex. Face angularly convex, diamond shaped, frons elongate, subconstricted at the antennal articulations. Clypeus fused with frons, widening out posteriorly, posterior margin slightly notched in the middle, reaching beyond posterior margin of genae. Lorae wider than the clypeus anteriorly, not nearly touching posterior margin of genae. Posterolateral margin of face oblique, not angulate almost direct between eye and clypeus. Antennae long, reaching at least beyond last sternite. Pronotum finely striate transversely, anteriorly arched, lateral margins evanescent. Scutellum a trifle wider than long. The venation of tegmina and wings is so feeble that I have not been able to interpret it; it seems to be Phrynomorphoid.

1. *pallida*, sp. nov. (Pl. XXXII figs. 12-14.)

Pale golden yellow. Eyes brownish red.

Male: unknown.

Female: last sternite short, posterior margins slightly notched; pygofers marked with a groove on each side.

Length, 7 mill.

Hab: Queensland, Bundaberg, (ix-xii).

Only one female unfortunately of this interesting form.

Giffardia, gen. nov.

Superficially allied to *Dorycephalus* etc., but is probably an offshoot from some form near *Phrynomorphus*.

Head elongate, tapering; vertex longer than wide across the eyes, about 5 (male) 6 (female) (This is not absolutely constant) times as long as wide between eyes at base, prolongation elongate-triangular, flat, porrect or slightly declivous towards the apex, longitudinally carinate. Frons elongate, a little more than four times as long as wide between antennae. Clypeus a trifle wider at apex than at base, a little wider than the lorae which do not nearly touch its posterior margin. Eyes large, elongate, suboblique, not included in the curve of the head. ocelli small, on the anterior margin of the head, a little remote from the eyes. Antennae elongate, socketted at about one-third of the length of the eyes. Pronotum arched anteriorly pronotum and scutellum longitudinally carinate. Tegminal venation simple, 4 discoidals and 5 apical; wing venation normal. Posterior femora swollen a little at apex, with two hooks.

1. *dolichocephala*, sp. nov. (Pl. XXII, figs. 4 and 5.)

More or less pale yellowish testaceous, a longitudinal brownish line from apex of vertex to posterior margin of scutellum, the keel on these parts being often pale and the brown line more or less interrupted, sometimes irregularly widened, on the vertex. On each of the genae is a thin brown smudged line, uniting anteriorly on the frons. Tegminal veins whitish, whole internal margin smoky, as also two small spots, one on each side of the 2nd apical vein. Leg hairs pale.

Male: Tegmina extending beyond apex of abdomen.

Female: Tegmina not extending to apex of abdomen.

Length: (male) 5½-6½, (female 8¼ mill.

Hab: Queensland, Cairns (vii-viii) Kuranda, (viii) on grasses. The nymphs do not apparently differ from the adult in any important non-instaral characters.

Reuteriella Signoret.

Reuteria Signoret 1879, A. S. E. France (5) IX, 51 and 1880 op. c., X 45. (preocc.)
Reuteriella Signoret 1880 op. c., 365.

1. *flavescens* (Signoret.)

Reuteria flavescens Signoret 1880, op. c., 46 pl. 1, fig. 40.
Hab: Tasmania.

Thomsonia Signoret.

Thomsonia Signoret 1879 op. c., IX 51.
Thomsoniella Signoret 1880 op. c., X 52.

1. *arcuatus* (Motshulsky.)

Acocephalus arcuatus Motshulsky, 1859 Etudes Entom. VIII, 115; and 1863 Bull. Soc. Imp. Moscou XXXVI, 2 p. 100 (Sec. Melichar.)

Tetigonia kalidasa Kirkaldy, 1900 Entom. XXXIII, 294.

Thomsoniella arcuta Melichar, 1903 Hom. Ceylon 172.

This seems to me rather a *Parabolocratus* than a *Thomsonia*.

Hab: Queensland; Cairns (vii-viii), Kuranda (vii) Ceylon (my collection.)

2. *lineolatus* (Motsh.)

Platymetopius lineolatus Motshulsky 1859 Etudes Entom. VIII, 114 (Sec. Melichar.

Deltocephalus rubrolineatus Motshulsky, 1863 Bull. Soc. Imp. Moscou XXXVI, 2, p. 98 (Sec. Melichar.)

Thomsoniella porrecta Melichar 1903 Hom. Ceylon 173.

Walker's description of *Acocephalus porrectus* does not seem to apply to this.

Hab: Queensland Cairns (viii); Ceylon (my coll.)

This too seems to belong to *Parabolocratus* rather than to *Thomsonia*.

3. *kirschbaumii* (Stal.)

Hecalus kirschbaumii Stal 1871, O. V. A. F., 737.

Thomsoniella kirchbaumii (sic!) Signorea 1880 A. S. S. F. (5) X. 52, Pl. 1, f. 44.

T. kirschbaumii Melichar, 1903 Hom. Ceylon 171.

Hab: Queensland, Cairns (vii-viii); Ceylon (my coll.); India (Signoret); Philippines (Stal.)

Hecalus Stal.

Hecalus Stal, 1864, A. S. E., France (4), IV, 65; Signoret, 1879, op. c., IX, 61 and 226.

I. *pallescens* Stal.

Hecalus pallescens Stal, 1864, op. c., (4), IV, 65; Signoret, 1879, op. c., (5), IX, 270, Pl. 7, fig. 24.

I have not seen this species, which may be a trifle larger than *H. immaculatus*; it apparently has the head only slightly foliaceous (while in *H. immaculatus*, it is somewhat widely so); there is a black spot at the apex of the clavus and 4 longitudinal brown bands on the tergites. The tegmina reach nearly to apex of abdomen.

Female: Length 10 mill.

2. *immaculatus*, sp. nov. (Pl. VII figs. 1-2.)

Very similar to the preceding, but the head is a little longer and broader, and the whole insect is pale greenish, shading off a little darker or lighter, but immaculate. All the examples collected have the tegmina not reaching as far as the apical margin of the (apparent) second tergite.

Female: sheath rosy.

Hab: Queensland, Cairns (vii-viii), Kuranda (viii) on grasses.

Cephalelus Percheron.

Cephalelus Percheron, 1832, Mag. Zool., II, Pl. 48; Burmeister, 1838, Gen. Ins., (No. 4) Pl., Signoret, 1879, A. S. E. France (5). IX, 50 and 259.

Dorydium Burmeister, 1835, Handb. Ent., II, 106; Kirby, 1894, T. E. S. London, 412.

1. *brunneus* Waterhouse. (Pl. XXIV, f. 5-6.)

Cephalelus brunneus, G. B. Waterhouse, 1839, T. E. S. London, II, 195.
Hab: New South Wales, Sydney, (i. also Waterhouse).*

2. *marginatus*, Waterhouse.

C. marginatus, Waterh., l. c.
Hab: King George's Sound.
I cannot identify this satisfactorily; I think two forms are confused. The nymphs in this genus are in all stages very similar to the adults.

Paradorydium Kirkaldy.

Dorydium Burmeister, 1838, Gen. Ins., (No. 5); and 1839, Handb. Ent., II, 1006; Signoret, 1879, A. S. E., France, (5), IX, 261. Pl. VII, figs. 21-2.
Paradorydium Kirkaldy, 1901, Entom. XXXIV 339.

1. *menalus* sp. nov.

Testaceous, or more or less rosy, or more or less tinged with ferruginous, veins paler. Head, pronotum and scutellum obscurely and smudgily flecked with blackish brown, the punctures being darkish. Sterna and sternites usually more or less tinged with pinkish. Elongate fusiform; head about as long as nota and tegmina together, gradually converging towards apex which is angularly rounded; sides acutely carinate for at least the anterior two thirds. Head, pronotum and scutellum finely and closely punctured, clavus lightly punctured. Vertex, pronotum and scutellum longitudinally carinate. Frons very strongly carinate, a little swollen near the clypeus. Pronotum with two sublateral keels on each side, a little more obsolescent than the median one, basal margin slightly angulately emarginate. Tegmina longer than abdomen.
Length: 10½ (male); 12 female) mill; width about ⅞ mill.
Hab: Queensland, Cairns (viii), Nelson (vii), Kuranda (viii.)
The head as seen in profile is much longer and flatter than in any other species known to me. The males are smaller than the other sex, and the vertex inclines a little to be spatulate apically.

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* Kirby says that *C. marginatus* and *brunneus* do not belong to *Cephalelus*; the description of the latter, however, at least, agrees very well with forms of *Cephalelus* before me.

2. *pseudolyricen* sp. nov.

Smaller than the preceding and the capital process shorter and more spatulate, the female being more narrowed at the middle of the process. Testaceous, minutely and closely punctured and spotted with brown, apex of process dark brown; two black spots on anterior margin of scutellum near antero-lateral angle. Tegmina pale yellowish brown, lateral margins pallid. Sterna (except laterally) and abdomen (more or less) blackish. Capital process somewhat ascendant apically, about $2\frac{1}{2}$ times as long as the width of the head basally. Tegmina longer than abdomen, with the nota about two-thirds to seven-eighths longer than the head.

Length: $5\frac{3}{4}$ (male), $8\frac{1}{4}$ (female) mill.

Hab: Queensland, Brisbane (xi), Bundaberg (ix-xii.)

3. ? *foveolatum* (Signoret).

Dorydium (?) *foveolatum* Signoret, 1880, A. S. E. France (5), X, 144. Pl. I, f. 39.

Hab: West Australia (Signoret).

Dorycephalus Kush.

Dorycephalus Kushakevitsh, 1866, Trud'i Russk. IV, 102; Signoret, 1879, A. S. E. France (5), IX, 265.

1. *ianthe* sp. nov.

Testaceous with a ferruginous tinge on the head. Abdomen mostly black above, punctured very finely and closely with golden yellow. Head nearly twice as long as wide, about four times as long as the pronotum.

Length: $6\frac{3}{4}$ mill.

Hab: Queensland; Bundaberg (ix-xii).

2. *subreticulatus* sp. nov.

Allied to the preceding but darker; the head narrows more towards the anterior margin and is more acute there. Pale testaceous, very closely and finely punctured and freckled with brownish and golden-yellow. Tegmina with brownish veins.

Head nearly one-half longer than wide, 3½ times as wide as pronotum. Tegmina subreticulate.

Length: 6½ mill.

Hab: New South Wales, Sydney (ii).

3. *trilineatus* sp. nov.

Somewhat similar to the last named; a dark brown line from anterior margin of head to posterior angle of scutellum (divided on vertex by pale median carina); lateral margins of tegmina broadly blackish brown, narrowing a little apically, the margins pale.

Length: 6 mill.

Hab: New South Wales.

Tartessus Stal.

Tartessus Stal, 1865, O. V. A. F., XXII, 156; Signoret, 1880, A. S. E. France, 347.

This is a characteristic Australian genus, though it stretches into the Philippines, Malays, etc. It must be very rich in species as Signoret admits 14, and I have a number before me unworked. They seem all to be arboreal.

1. *syrtidis* sp. nov. (Pl. XXIV, fig. 9).

Pronotum and scutellum clear yellowish. Head testaceous, the top broadly black transversely, lengthening on the tempora; there is a broad curved black stripe at the base of the genae, beneath the eyes, reaching the frontal sutures at the antennal scrobes. The frons has a pattern (figured) in black and the apex of clypeus and of lorae, etc., are the same color. Eyes brown. Sterna (mostly), sternites basally, sternopleurites entirely, posterior femora mostly, genital segments (except lateral margin of plate in male, narrowly pale),black or blackish; rest of underside mostly testaceous. Tegmina subhyaline, pale ferruginous with a lilac iridescence; a transverse median hyaline stripe and a large hyaline, marginal spot towards the apex of the subapical transverse veins, blackish; and a spot near the apex of the costal cell blackish ferruginous. Wings hyaline, veins black. Vertex scarcely prominent in front of eyes, very greatly rounded. Eyes large, reaching posteriorly to about half of the length of the pronotum. Ocelli much nearer the eyes than the middle line.

Length: (Female)9 mill.

Hab: Queensland, Bundaberg (xi on sandhills; bred from *Eucclyptus*).

Tribe *Macrostelini.*

(=Cicadulini V. D.)

Under this name it is convenient to separate forms with shorter vertex and simpler venation, usually with only one subapical cell; at the same time it is probably not a natural division. It probably embraces (1) *Balclutha* Kirkaldy, (2) *Macrosteles* Fieber, (=*Cicadula* Edwards=*Limnotettix* Woodworth, etc.), (3) *Coryphaclus* Puton, (4) *Grypotes* Fieber, (5) *Aconura* Lethierry, (6) *Eulcimonios* Kirkaldy (=*Limotettix* J. Sahlb.), and some new genera. *Limotettix* Sahlb., is a mixture of *Phrynomorphus* and *Thamnotettix*. Most, if not all, of these forms are grass-feeders.

Eulcimonios gen. nov.

Jas. Edwards has separated off as a genus (not recognized by Puton) those forms in which the lateral margins of the pronotum are obsolescent and are not (or very obsolescently) keeled. Unfortunately he has used for this the name *Limotettix* (an orthographical monstrosity.) J. Sahlb, the type forms of which are partly *Phrynomorphus*, partly *Deltocephalus*.

The Edwardsian species seem to be worthy of at least subgeneric rank and I think that the future will accord a full title.

1. *demittendus* sp. nov.

Vertex testaceous tinged with brown; 4 brownish specks on apical margin, 2 on basal margin. Pronotum and scutellum testaceous tinged with green. Tegmina greenish, or pale greenish testaceous, apically and costally colorless, veins pale greenish testaceous. Frons pallid rufescent with narrow obsolescent brownish radiating lines from very near the middle line. Vertex angularly rounded in front, about one-half longer medianly than next to the eyes. Lorae very large, almost circular, about 3 times as wide as the clypeus. Tegmina with 4 discoidals and 5 apicals.

Length: $3\frac{1}{8}$ mill.

Hab: New South Wales, Sydney (i).

Pettya gen. nov.

Elongate; vertex more than twice as wide as long dorsally, anteriorly rounded, bent over in front and extending ventrally about as far as antennal scrobes; demarcation from frons not very distinct; posteriorly above tumidly raised, posterior margin much more so than the apical margin of pronotum. Head distinctly wider than pronotum anteriorly. Clypeus oval, about as wide as frons apically. Pronotum large, reticulate, almost as long as wide, about two and a half times as long as vertex dorsally, strongly arched anteriorly, lateral margins long, not carinate, posterior margin subtruncate. Tegmina with two discoidal (1 subapical) and 4 apicals. Wings without submarginal vein.

1. *anemolua* sp. nov. (Pl. XXXII, fig. 10).

Head pale luteous; frons and clypeus with an orange tint, genae testaceous, eyes grey. Pronotum and scutellum greyish white, the former closely reticulate with greyish-brown. Tegmina and wings milk-white hyaline, tegminal costa pale yellow. Tergites black, one or two segments partly pale; beneath pallid, more or less black laterally. Legs orange yellow.

Length: 6 mill, width $1\frac{1}{8}$ mill.

Hab: Queensland, Cairns (viii).

Nesosteles gen. nov.

Allied to *Macrosteles* but the radial is not obsolescent and the wing venation is different. There are a number of species represented in the collection, out of which I have had time briefly to describe 5 only.

Type *hebe*.

1. *hebe* sp. nov. (Pl. XXXII, fig. 8).

Head pale sordid testaceous. Pronotum and scutellum whitish testaceous, with a faint brownish longitudinal median line on the former (and sometimes two obsolescent submedian lines). Underside, legs, etc., pallid. Tegmina whitish-grey, subhyaline, veins white; wings milky white, veins more or less smoky. Mesonotum and tergites blackish, genital segments more or less pale.

Length: 4 mill.

Hab: Viti Isles (viii).

2. *glauca* sp. nov.

Closely allied to the former, but smaller and more yellowish. Pale yellowish testaceous, with a tinge of grey; sterna, legs, etc. paler. Tegmina and wings pale milky subhyaline. Abdomen pale sordid yellowish, more or less black discally.

Length: 3½ mill.

Hab: Cairns (viii), Koebele's No. 2259; and I think 2292 is either this, or a very closely allied species.

3. *sanguinescens*, sp. nov. (Pl. XXXII, fig. 9).

General color dark crimson-red. Head testaceous (or yellowish testaceous or pinkish); vertex with three narrow crimson longitudinal lines ,the lateral ones with a very short transverse line at their apices. Face testaceous, frons with pale red-brown, obliquely transverse parallel lines on each side of the middle. Pronotum testaceous or pinkish with a narrow median longitudinal crimson line, two sublateral outwardly-curved lines of same color and three crimson spots on anterior margin and one in posterior angle, this and the middle anterior one sometimes united; these spots often darker. Tegmina crimson red, varyingly obscurely suffused with brownish, veins white and very conspicuous; Costal and intero-apical cells hyaline, some of the latter more or less smoky. Wing veins darkish. Propleura, sterna etc., abdomen mostly (except the sanguineous lateral margins and genital segments) black. Legs mostly pallid.

Female: Plate testaceous; last segment deeply acutely notched.

Length 4¾-5 mill.

Hab: Queensland, Brisbane (vi), Bundaberg (ix-xii.)

4. *sordidior* sp. nov.

Closely allied to the last, but a trifle smaller, and color different, the sanguineous being paler and browner, while the frons is not striped.

Female: last segment very slightly roundly emarginate.

Length 4½ mill.

Hab: Queensland, Brisbane (vi.)

5. *taedia* sp. nov.

Sordid lemon yellow, vertex with two black spots near the anterior margin; frons discally black, clypeus smoky. Scutellum dark brownish. Commissural cell of clavus, basal part of costal cell and apical half of tegmina smoky. Abdomen basally black.

Length 4¼ mill.

Hab: Queensland, Kuranda (viii.)

This will probably form the type of a new genus.

Subfamily Agalliinae.

(Bythoscopidae of many authors.)

I have retained this subfamily for the sake of convenience but I cannot see any good characters by which it can be separated from the Iassinae, especially from such forms as *Tartessus* etc., the position of the ocelli being so slightly different.

The nomenclature is horribly confused, all authors up to 1900 (when I pointed the fact out) having ignored Lewis' fixation of *lanio* as the type of *Bythoscopus*.

The following is the synonymy of several vexed genera:

1. *Bythoscopus* Germar, type *lanio* (Linn.) Lewis.
    Macropsis auct. nec Lewis.
    Batrachomorphus Lewis, type *irrorata* (=*microcephala*)
    Stragania Stal. (placed by Fowler among the *Gyponinae*!)
    Pachyopsis Uhler.
    Gargaropsis Fowler.
2. *Oncopsis* Burmeister, type *flavicollis* (Linn.) Westwood,
    Macropsis (B) Lewis.
    Bythoscopus auctt.
3. *Macropsis* (A) Lewis, type *virescens* (Fabr.) Westwood.
    subg. *Pediopsis* Burmeister, type *tiliae* Burm.

Tribe *Agalliini*.

Epipsychidion gen. nov.

Forms a sort of link between the Agalliinae proper, and the Iassinae as represented by *Tartessus*; it is here placed in the former as the ocelli are ventral though not very distinctly.

Vertex dorsally very short, anteriorly obtuse-angled, posteriorly rotundately-emarginate (apex of emargination nearly reaching as far as anterior margin ol eyes), obliquely striate on each side of the middle. Ocelli inserted on the vertex ventrally, immediately below the top of the head. Antennae inserted under a shallow ledge, but lying in a rather deep groove. Pronotum subhemispherical, transversely striate. Scutellum transverse. Tegmina punctured, especially on the clavus; 5 discoidals (of which two are subapical) and 5 apical cells.

1. *epipyropis* sp. nov. (Pl. XXIII figs. 4-6.)

Pale cinereotestaceous, sordid testaceous beneath. Pronotum with 3 distinct, narrow, longitudinal black lines, which continue anteriorly and posteriorly on to vertex and scutellum (the middle one much thickened on the vertex and scutellum and trifurcating anteriorwards on the pronotum.) Clypeus etc., blackish brown, frons obscurely and sparsely marked with brown. Anterior intermediate femora annulated with dark brown. Tegmina with veins white, dark brown and black. Abdomen brownish-testaceous, a blackish brown median line on last tergite.

Male unknown.

Female: Ovipositor extending beyond tegmina, pygofer elongate, but not so long as the above.

Length

Hab: New South Wales, Sydney (i-ii Koebele's No. 2373), arboreal.

Vars: In some examples, the black lines are fainter and are bordered with yellowish brown.

The nymph (fig. 6) has a remarkably elongate head.

Eurinoscopus, gen. nov.

The Australian representative of *Bythoscopus* Germ., Kirk., from which it differs by the venation; the latter has the median discoidal undivided, so that there are only two small subapical cells, while in the former there are three well defined small subapical sells also in *Bythoscopus* there is only one transverse vein standing on the cubital, in *Eurinoscopus* there are two.

There are two sections, viz:

1. Tegmina pale yellowish cinerous (sometimes tinged with green or rose), with blackish granulations on the veins.
2. Tegmina greenish or pale yellowish green, without granulations.

Section I.

I. *lentiginosus* sp. nov. (type.)

Vertex and pronotum pale greenish, minutely spotted with black, the latter also smokily clouded through its entire length in the middle. Scutellum pale castaneous, with four dark spots on the anterior margin (or the two middle ones may coalesce and extend to the posterior angle.) The rounded frons is blackish, except the lateral margins which are very narrowly pale, and there are two small black spots at the sides of the antennal scrobes below the ledges. Rest of the underside pallid, pleura and base of the genital segments dark, the remainder of the latter minutely spotted with black. Tegmina subhyaline, pale cinereous yellow, (base sometimes more or less black.) Apices of intermediate femora and of posterior femora and tibiae black. Sternites pallid testaceous, greenish or reddish.

Frons convex, lorae large. Pronotum much more convex than in the European *B. microcephala*, and anteriorly declivous, anterior margin more arched, lateral margins shorter; tegmina reaching well beyond apex of abdomen.

Male: Last segment truncate, pygofers very short, valve elongate (the tip black), nearly as long as pygofers.

Female: Last segment subtruncate, very slightly sinuate, pygofers granulate.

Length: $4\frac{7}{8}$ mill.

Hab: Queensland, Kuranda (viii), Nelson (vii).

2. *sontiates* sp. nov.

Sparsely freckled, otherwise little related to *lentiginosus*, being more elongate and narrowed. Pale testaceous, more or less tinged with pink or greenish or yellowish green, a longitudinal narrow testaceous line on vertex, pronotum and scutellum. Ocelli red. Frons and lorae much as in the type.

Males rather smaller and darker.

Female: Last pleurite very slightly obtusely produced in the middle, pygofers longer than in the type, with short bristly hairs.

Length: $4\frac{7}{8}$-$5\frac{1}{4}$ mill.

Hab: Queensland, Kuranda (viii).

3. *soboles* sp. nov.

Very close to the last, but larger and the anterior margin of vertex (dorsally) wider and not so rounded; frons flatter. Lateral margins of pronotum more parallel.

Length: $6\frac{7}{8}$ mill.

Hab: Queensland, Kuranda (viii).

4. *dryas* sp. nov.

Allied to *E. sontiates,* but less elongate and frons flatter.

Pale testaceous, corium lightly granulate with brown.

Male: Plates elongate hemispherical, not as long as the pygofers.

Female: last segment obtusangularly emarginate, laterally produced acuminately.

Length: $4\frac{7}{8}$-$5\frac{1}{8}$ mill.

Hab: Queensland, Bundaberg (ix-xii).

Section 2.

The species of this section are unsatisfactory; they are all immaculate greenish or testaceous and present only trifling differences that can be characterized.

5. *pelias* sp. nov.

General form of *B. dryas,* but a little more elongate.

Greenish; head and scutellum often yellowish; underside more or less testaceous. Frons convex, though not so much so as in the type. Inner apical cell and appendix colorless.

Male ventral segments similar to those of *B. dryas.*

Female: last segment slightly roundly emarginate, laterally produced acuminately, pygofers elongate.

Length: $4\frac{1}{4}$-6 mill.

Hab: New South Wales, Sydney (i-ii), Mittagong (i).

6. *molestia* sp. nov.

Allied to the last, but narrowed and more elongate; vertex distinctly, though obtusely, angulately rotundate in front; in the middle more than one-half longer than at eyes which extend laterally very slightly beyond the pronotum. Frons nearly as convex as in the type. There are 3 transverse veins standing on the cubital.

Female: last segment not produced acuminately laterally.

Length: 5 mill.

Hab: Queensland, Kuranda (viii).

7. *pelamys*, sp. nov.

The largest of the Australian species. Similar to *B. pelias* but larger and more elongate.

Testaceous. Frons fairly convex, vertex dorsally short, wide, little wider medianly than at the side.

Female: last segment with a short acute lateral spine.

Length: 6⅛-6⅞ mill.

Hab: New South Wales, Sydney (i).

Pedioscopus gen. nov.

Allied to *Idiocerus* Lewis, but differs by having no subapical cells. There is a tegminal appendix, and the supernumerary cell of the wing is present. In the males the antennae are simple. Frons convex, anterolateral margins rounded. Type *philenor*.

1. *philenor* sp. nov.

Head and pronotum pale greyish-yellow, frons (except narrowly laterally, pallid), clypeus, lorae, small spot at antennal scrobes, etc., blackish. Pronotum with 2 large rounded black spot. Tegmina hyaline, basal half tinged with yellowish; costa, a longitudinal streak down the middle, the principal veins, more or less, smoky. Apex of anterior tibiae and anterior tarsi black.

Male: apex of valve black.

Length: 4 mill.

Hab: Queensland, Cairns (viii).

2. *polydoros* sp. nov.

Larger than the type and differently patterned. Pale olivaceous, paler beneath, four black spots on vertex, the larger pair (which are a trifle less than their own diameter from the eyes) visible from above. Frons with 8-10 small spots. Pronotum with two sublateral blackish wedgelike spots close to anterior margin. Scutellum with two wedgelike black spots on anterior margin close to anterolateral margin, and two small round black spots on the middle, one on each side of central line. The spots on vertex, pronotum and the wedges on scutellum are in line Tegmina immaculate. A black spot on propleuron.

Female: Ovipositor black, valve much longer than in *P. agenor*, being as long as the rest of the body.

Length: 4 mill.

Hab: Queensland, Nelson (vii).

3. *agenor* sp. nov.

Size and coloring of the type, except as below, and may possibly be the female of that species. Vertex with two black spots nearer the eye than their own diameter and visible from above. Frons with two similar sized spots at its extreme base and nearer together than are the vertical spots; a small spot at the scrobes and the clypeus, black. Pronotum with 2 big black spots (and sometimes a line at the posterior margin). Sterna, a spot on propleuron, etc., black. Anterior tibiae concolorous.

Female: ovipositor black.

Length: 4 mill.

Hab: Queensland, Cairns (viii).

Tribe *Eurymelini.*

Confined to Australia, the species congregate on *Eucalyptus* where they "bore into the green bark....the sap exudes, dies and falls to the ground, sometimes in great quantities," (Ann. Mag. Nat. Hist., XV, 35, (1845).

There are only two genera known, one forming two subgenera:

1. Tegmina with simple venation and with an appendix; wings with normal venation. Vertex and frons forming one single curve, in profile. Posterior tibiae with a double row of spines. Last abdominal sternite composed of two parts which overlap posteriorly but are separated anteriorly; they reach the lateral margins of the abdomen. 1. *Eurymeloides* Ashmead.

1a. Tegminal venation reticulate apically; wings with two veins inside the supernumerary cell. Vertex and frons forming two or three curves in profile. Posterior tibiae with two strong spines. 2. *Eurymela* Lep. & Serv.

1b. Last abdominal sternite formed as in *Eurymeloides*. 2a. *Eurymelops*, subg. nov.

1c. Last abdominal sternite consisting of two similar plates, which however do not nearly reach the lateral margins of the abdomen. 2b. *Eurymela*, in sp.

Eurymeloides, Ashmead.

Eurymela Div. B. Signoret.

Eurymeloides Ashmead, 1889, Ent. Amer., V, 126.

Ashmead has founded this genus in the most improper manner, viz.: in one line of description, without mention of species. The venation both of tegmina and wings is often very irregular. Usually there is one vein standing on the cubital, sometimes two, sometimes none at all, in the same species. Sometimes the transverse apical veins are incomplete, a cell thus reaching from the first forking of the median to the apex of the tegmen.

1. *hyacinthus* sp. nov.

Black; eyes pale castaneous. Posterior margin of pronotum, a small spot (of varying size) on clavus, a larger (though still small) spot on corium about the apex of the basal third, and a more of less narrow wedge-shaped band of varying thickness and extent (sometimes reaching clavus, sometimes not) on corium at a level with apex of clavus, white. Tegminal ground color dark metallic purple, wings dark smoky. Posterior part of scutellum (or only the lateral margins very narrowly) ochraceous. Lateral margins of frons, lateral margins of lorae and interior margins of genae, coxae, sternites (excluding genitalia), tergites broadly postero-laterally, and middle two-thirds of basal segment of posterior tarsi—whitish testaceous.

Length: 10½-12 mill.

Hab: Queensland, Cairns (vii-viii), Nelson (vii), Kuranda.

Var: A narrow longitudinal stripe on vertex and two small spots near anterior margin of pronotum, ochraceous.

Nymph. No chitinous spines on the legs, only short, feeble hairs. Vertex, two spots on pronotum, the ground color of nota and abdomen above castaneous; frons, lorae, clypeus, rostrum, sternites, black. Genae pallid. Nota and terga marked with black.

2. *cumulosus* sp. nov.

Head, pronotum and scutellum blackish brown, speckled with testaceous; posterior two-thirds of genae and exterior half of lorae, whitish, more or less punctured finely with brownish red. Tegmina blackish brown, a white blotch near the base (with a black speck in the middle), an irregular stripe near the apex and one or two small spots near the commissure. Wings smoky, veins black. Legs black, coxae, base of femora, base of spines on posterior tibiae, and basal four-fifths of 1st. segment of posterior tarsi, whitish. Abdomen pale yellowish, genital segments black. Penultimate sternite obtusangularly emarginate, pygofers rather short and stout.

Length: 8½ mill.

Hab: Queensland, Brisbane (vi).

Var: I have in my own collection, some forms from Queensland, which I can only refer to this species; the head and pronotum are more irrorated with testaceous. Scutellum ochraceous irrorated with black, the anterolateral angles black. The tegminal veins are pinkish where they cross over the whitish fasciae. Abdomen sanguineous, genital segment black.

3. *bicinctellus*, sp. nov.

Closely allied to *E. bicincta* (Erichson). Shining black; posterior three-fourths of genae, exterior half of lorae, the coxae, basal three-fourths of femora, base of tibial spines, basal two-thirds of 1st. segment of posterior tarsi, testaceous. Posterior margin of pronotum very narrowly, an oblique stripe from about middle of costa to middle of lateral margin of scutellum, and another band (narrowing internally) near apex of tegmina, white. Wings smoky, veins black.

Male: Sternites black, posterior margin of each narrowly testaceous, last segment with a large testaceous triangle. Genital segment black.

Female: Sternites pale testaceous, genital segment black. Last segment very short, almost concealed by previous one, apically sinuate, medianly notched.

Var: Dark parts of head, pronotum and scutellum more or less, or entirely, castaneous.

Length: 6½-7¼ mill.

Hab: Queensland (my collection), New South Wales, Mittagong (i).

4. *ornatus*, sp. nov.

Allied to *E. cumulosus*. Head and pronotum dark brown mottled with whitish. Exterior half of lorae whitish. Scutellum pale castaneous, with a broad central stripe (becoming obscure anteriorly) and the anterolateral angles blackish. Pleura black, propleura bordered narrowly exteriorly with whitish. Sterna, coxae, basal part of femora, tibial spines basally, basal three-fourths of 1st. segment of posterior tarsi, sternites (except some black markings) testaceous. Tegmina, purplish black, picturation as in *E. bicinctellus* but broader and the basal stripe more transverse, reaching only to about one-third of costal length. Wings as in *E. bicinctellus.*

Male: Genital segment more elongate dorsally than in *E. bicinctellus.*

Length: 8¾ mill.

Hab: Queensland, Cairns (viii).

5. *rubrivenosus*, sp. nov.

Head, pronotum and scutellum pale castaneous, freckled with yellow. Clypeus, lorae and underside yellow; tibiae and tarsi more or less castaneous. Tegmina subhyaline yellowish, the cells more or less obscurely clouded with brownish, veins sanguineous, also most of clavus. Wings smoky, veins black.

Female: Last segment notched sublaterally; pygofers elongate.

Length: 5¾ mill.

Hab: New South Wales, Mittagong (i).

6. *lentiginosus*, sp. nov.

Very closely allied to the preceding but much narrower posteriorly, more triangular in form. Head and pronotum more or less marked with black. Tegmina yellowish cinereous, more or less infuscate towards the apex, with a few translucent, colorless markings; principal veins sometimes pale sanguineous.

Length: 5-5⅔ mill.

Hab: Queensland, Brisbane (vi).

7. *pulchra* (Signoret).

Eurymela pulchra Signoret op. c., 508, Pl. 17, f. 10.

Hab: Victoria, Bacchus Marsh (my collection).

The following species of *Eurymeloides*, described from Australia, are unknown to me:

8. *Eurymela lineata* Signoret, 509, fig. 11.

9. *E. adspersa* Signoret, 510, fig. 2.
10. *E. ocellata* Signoret, 511, fig. 13.
11. *E. punctata* Signoret, 511.
12. *E. trifasciata* Signoret, 512, fig. 14.
13. *E. porriginosa*, Signoret, 512.
14. *E. bicincta* Erichson, 1842, Wiegmann's Archiv., VIII, 286. (The type of the genus).

Eurymela Lep. and Serv.

Eurymela Lep. Serv., 1825, Enc. Meth., X, 603.
Eurymela Div A., Signoret, 1850, A. S. E. France, (2), IX, 497.

subg. 1. *Eurymelops*, nov.

1 *rubrovittata*, Am. & Serv.

Eurymela rubrovittata Am. Serv., 1843, Hem. 555, Pl. 10, fig. 4.
Hab: Victoria, Bacchus Marsh (my collection).

2. *bicolor*, Burmeister.

Eurymela bicolor Burm, (1837?) Gen. Ins., *Eurymela* No. 1. Signoret, 1850, A. S. E. F., 503, Pl. 17, f. 9.

I do not know this species.

subgenus, *Eurymela* in spec.

3. *rubrolimbata*, sp. nov.

Allied to *E. bicolor*. Black or blackish; posterior margin of genae more or less widely pale reddish. Trochanters, basal half of femora (or almost all posterior femora), tibiae (mostly), claval commissure and costal margin (both narrowly) reddish. Tegmina purplish black, a stripe across middle of clavus, and a subcontiguous one across the corium, also a broader one nearer the apex, white.

Male: last sternite slightly roundly emarginate, genital segment somewhat elongate.

Female: penultimate sternite obtusangularly emarginate, last sternite truncate.

Var: Posterior half of pronotum lemon yellow, encroaching medianly on black anterior half.

Length: $9\frac{1}{2}$-$9\frac{3}{4}$ mill.
Hab: New South Wales, Mittagong (i).

4. *plebeia* sp, nov.

Allied to *E. fenestrata.* Castaneous or orange; vertex with a short stripe on each side of the base of the frons, 2 spots on pronotum (sometimes absent, sometimes much enlarged), 3 spots at apical margin and at posterior angle (sometimes concurrent), apex of femora, the tibiae and tarsi (except the white basal three-fourths of basal segment of posterior tarsi), propleura more or less, etc., black. Genae and lorae testaceous. Tegmina purplish or purplish black, sometimes with a greenish glint, lateral margins narrowly ochraceous, widening basally, internal margins more or less widely coppery; a white spot near costal margin at about third of its length, and another one nearer apex, also a speck on clavus (sometimes absent.) Wings smoky black with purple glint; veins black. Abdomen more o less tinged with sanguineous.

Male: Genital segment black.

Female: Genital segment orange, apex and last segmen (plates) blackish.

Length $12\frac{1}{2}$ mill.

Hab: Victoria, Bacchus Marsh (my collection).

5. *lubra*, sp. nov.

Allied to *E. distincta*, from which it apparently differs principally by the red abdomen, etc.

Head, pronotum, scutellum, tegmina, etc., metallic purplish black; genae and exterior half of lorae testaceous. Abdomen above and the whole of the underside sanguineous, except part of propleura, apex of femora, the tibiae and tarsi (except the pale basal three-fourths of 1st segment of posterior tarsi) which are black. A spot near the base of tegmina and a little one (contiguous) on clavus, and one near apex of tegmina—white.

Male: Genital segment black, more or less sordid ochraceous laterally.

Female: Genital segment sanguineous; last segment (plates) and apex of genital segment, black.

Length 13-$14\frac{1}{2}$ mill.

Hab: Victoria, Bacchus Marsh (my collection).

The following species belonging to the typical subgenus have also been described from Australia:

6. *ruficollis* Burm. (1837?) Gen. Ins., Eurymela No. 3.
7. *erythrocnemis* Burm., l. c., No. 4.
8. *marmorata* Burm. l. c., No. 5 (=*Bythoscopus nigroaeneus* Walker.)
9. *maura* (*Cicada*) Fabricius 1775 Syst. Ent., 686.
10. *fenestrata* Lep .Serv. 1825, Enc. Meth., X, 604.
11. *discoidalis* Signoret 1850 A. S. E. France (2) VIII, 505.
12. *distincta* Signoret op. c. 506 (=*speculum* Walker, 1851, List. 641.)
13. *vicina* Signoret, l. c.,
14. *generosa* Stal, 1865 O. V. A. F., XXII, 156.
15. *rubrofasciata* Stal, l. c.

The following have been also described under *Eurymela*, their generic position being uncertain from the description:

1. *lignosa* Walker, 1858 Suppl., 166.
2. *latifascia* Walker 1851 List. 639.
3. *basalis* Walker op. c., 640.
4. *suffusa* Walker, l. c.
5. *discifera* Walker op. c. 641.
6. *terminalis* Walker op. c., 642.
6. *livida* Walker l. c.
7. *semifascia* Walker op. c., 643.
8. *decisa* Walker l. c.
9. *varia* Walker op. c., 644.
10. *atra* Walker op. c., 645.
11. *lacta* White, Eyre Exped. I, 433 Pl. IV, f. 3 (I have not seen description of this.)
12. *amplicincta* Walker 1858. Ins. Saund. Hom. 84.
13. *suffusa* op. c., 83.
14. *perpusilla* l. c.

Subfam. Eupteryginae.

This subfamily seems to be a natural development of the Macrosteline Tetigoniids in the direction of simplification and degeneration of the venation, the radial, median and cubital veins appear to spring altogether almost at the base itself of the tegmen and continue (as a rule) undivided right up to the transverse apical veins; the only exception known is the new genus *Ancono*. which from its general facies and structure must be included in this subfamily; at the same time the venation is quite different.

In many, perhaps a majority of the forms, the tegminal venation is scarcely visible much basal of the transverse apical veins The wing-venation seems to be most primitive in *Alebra*, *Erythroneura* representing some of the more degraded forms.

Little is known of their habits or metamorphoses, beyond the names of the food plants etc., except in the case of *Erythroneura comes*, which has been worked out, especially by Slingerland. Judging from his figures, the nymphs differ but little in general appearance from the adult.

Cicadula flavescens (Fabr.) has a very wide range and while feeding on many shrubs and herbs in Europe, is also very destructive to the Tea-plant in India. J. Sahlberg gives brief descriptions in various genera.

So far as I am aware, no Eupteryginae have previously been recorded from Australia and only 26 specimens were collected by Messrs. Koebele and Perkins; these form two new genera and fourteen new species, one of the latter being from the Viti Isles. There are none in Hawaii. The Eupteryginae are as a whole the daintiest of all the Tetigonioidea, a character well upheld by those about to be described.

The nomenclature of the genera is very confused, partly owing to the former persistent ignoring by European authors of *Eupteryx* Curtis, and the subsequent arrangement by which *Eupteryx* and its synonym *Typhlocyba* were kept separate. No less than six names proposed were preoccupied, while the pedants also amused themselves by altering two others.

In Jan. 1833 (not 1832 as usually cited), Curtis created (Ent. Mag. 1, 192) *Eupteryx* for *E. picta* Fabr. (=*atropunctata* Goeze) describing *hortensis* at the same time. Later in the year (before Easter) Germar erected *Typhlocyba* with 5 species, 4 of these belonging to *Eupteryx*; in 1833 Burmeister described in *Typhlocyba* 3 species, all of them belonging to *Eupteryx*, while *quercus* (Germar's 5th species) is only mentioned among 7 others as ((ferner gehoerend hieher." For *Typhlocyba* Puton, Edwards, etc., *Erythroneura* should be employed.

In 1838 (not 1840 as usually cited) Zetterstedt erected *Cicadula* for 23 species; in 1866 Fieber fixed *quatuorpunctata* Fall. and *fenestrata* H. S. (i. e. species of *Thamnotettix*) as types, but as neither of these was mentioned by Zetterstedt, this application is invalid. In 1871 J. Sahlberg made *smaragdula* the type (of the 4 species cited by Sahlberg in his typical division, *smaragdula* was the only one mentioned by Zetterstedt.) *Cicadula* therefore, as Sahlberg states, replaces *Kybos* Fieber, while for *Cica-*

dula Puton etc., should be employed *Macrosteles* Fieber.

The following table shows the affinities of the genera: (*Motschulskyia* Kirkaldy =*Conometopus* Motschulsky, is not included.)

1 Median and cubital veins united by a short stalk basally and apically........................1 *Ancono* gen. nov.
1a Corial veins not forked...............................2
2 Membranal appendix present.........................3
2a Appendix absent.......................................4
3 Complete submarginal wing vein.................... ....2 *Alebra* Fieber (=*Compsus* Fieber)
3a Wing with obsolescent submarginal vein (Sec. Baker).. ....3 *Protalebra* Baker (X)
4 Complete submarginal wing-vein.....................5
4a No submarginal wing-vein..........................9
5 Three apical wing cells (Sec. Baker)....4 *Eualebra* Baker
5a Two apical wing cells...............................6
5b One apical wing cell.................................8
6 Third wing vein forked...............................7
6a Third wing vein simple...........7 *Cicadula* Zetterstedt
7 At least two of the apical cells of tegment springing from the transverse veins..........5 *Dikraneura* Hardy (subgenus 1 *Erythria* Fieber =*Notus* Fieber.)
7a Only one of the apical cells springing from the transverse veins........................6 *Kahaono* gen. nov.
8 Face of the usual type................8 *Empoasca* Walsh
8a. Frons narrowing basally, meeting at the base in an acute angle; medianly carinate; lorae very elongate.. ....9 *Heliona* Melichar
9 First two wing-veins subparallel.................... ....10 *Eupteryx* Curtis, (=*Typhlocyba* Germar)
9a First two wing-veins confluent towards apex..........10
10 Second apical cell pedicellate, third irregular........ ..11 *Empoa* Fitch (=*Typhlocyba* Puton=*Anomia* Fieber.)
10a Second apical cell not pedicellate, third oblong........ ..12 *Erythroneura* Fitch (=*Zygina* Fieber=*Idia* Fieber.)

Aneono gen. nov.

Differs from all other Eupteryginae by the venation of the tegmina, which is best explained by the figures. It is remarkable not only for the distinctness of the veins at the base of the tegmina but for their forkings and anastomosings, thus connecting the last described tribe with the typical Eupteryginae.

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* It is a pity that Baker has applied the misleading term '*Protalebra*' to this genus, as it is evidently a derivative of that genus or some ally not a precursor.

Head sub-foliaceous, produced in front of the eyes, roundly arched. Ocelli probably functionless, but vestiges large, dorsal, close to the anterior margin, nearer to one another than to the eyes. Apex of first segment of antennae reaching to lateral margin of head. Vertex long and narrow. Tegmina without an appendix. The radial vein seems to lose itself in the costal; the median and cubital have a short common stem and unite again in a short stem just basal of the apical cells. There is a discoidal cell. The median and cubital are the most distinct of the veins. (Pl. XXII, fig. 12, and Pl. XXXI, figs. 2 and 3).

1. *pulcherrima* sp, nov.

Vertex and pronotum bright orange yellow, the former tinged with pink, and with a broadish longitudinal pallid stripe, anterior (dorsal) margin also more or less pallid narrowly. Pronotum with a narrow longitudinal stripe, a dot on each side of this anteriorly, and a ʕ and ? laterally about the middle, pallid. Posterior margin very narrowly pallid. Scutellum reddish, posterior lobe blackish with two white spots. Basal two-thirds (or more) of tegmina rich crimson, darker on the clavus exteriorly; wedge on the clavus and the part of the corium between the cubital and median veins hyaline and somewhat infumate; 2 short wavy whitish lines on clavus and 2 white marks on corium, one (with a black spot at its apex) close to apex of clavus, the other at apex of area between median and cubital veins. Apical third of tegmina hyaline, more or less tinged with yellowish. Wings milkwhite, veins pale yellow. Underside pale testaceous or yellowish; frons more or less tinged with orange; basal sternites of abdomen more or less blackish.

Vertex between the eyes two-fifths wider than medianly long, base roundly emarginate. Pronotum transverse, subquadrangular, same length as head, posterior margin almost straight. Scutellum as wide as vertex between eyes and as long as pronotum, acuminately produced posteriorly, transversely sulcate near the posterior angle.

Female: Sheath at least 7 times as long as the ultimate abdominal sternite (which is sinuately excavate), with short white bristly hairs.

Length 3-3⅛ mill.

Hab: New South Wales, Sydney (i) Queensland, Bundaberg (ix-xii).

The clavus is much darker (red-black) in the Bundaberg specimens. One of the Sydney specimens is the type.

Dikraneura Hardy.

Dikraneura Hardy 1850 Tr. Tyneside Field Club 1 423.
Dicraneura Gillette 1898 P. U. S. N. Mus, XX 715.

1. *honiala*, sp. nov.

Superficially not unlike *D. flavipennis* (Zett.), but with a more elongate crown, etc.

Head, pronotum, scutellum and general ventral aspect, immaculate pale brownish-yellow; eyes blackish grey. Tegmina pale golden yellow, shining; a black spot at the apex as in *D. unipuncta* (Gillette), but ringed around with whitish, 1st apical cell whitish narrowly ringed with brownish; a small oblique brownish black line from costa inwards at about the middle. Wing-veins pallid. Legs immaculate pale yellow, hairs whitish.

Vertex subconvex, elongate triangular, longer than the pronotum, posteriorly roundly emaginate. Pronotum posteriorly truncate. Venation of tegmina very similar to that of *D. unipuncta* as figured by Gillette, except that the corial veins are entire and distinct and that the first apical cell is 5-sided rather than 3. Alar venation more like that of *D. carneola* (Stal) as figured by Gillette, but the submarginal vein is entire and unbroken.

Female: Ovipositor and pygofers longer than the rest of the abdomen.

Length 3¾ mill.

Hab: Queensland, Kuranda (viii).

2. *aneala* sp. nov.

Vertex, frons, pronotum and scutellum orange brown, the two latter obscurely so. Eyes blackish, genae etc., mostly dark. Tegmina pale greenish yellow, apical cells dilute smoky. Wing-veins brownish. Abdomen striped transversely black and grey. Genital segments palid. Legs with pale hairs.

Tegminal venation similar to that of the preceding, except that the 1st apical cell is 4 sided (the basal margin being slightly obtuse angled), the interior margin almost as long as the apical margin, the costal and interior margins being subparallel. Alar venation as in *D. unipuncta*.

Female: Last sternite somewhat deeply roundly biemarginate.

Length 3 mill.

Hab: New South Wales, Sydney (ii).

Kahaono gen. nov.

Allied to *Dikraneura* Hardy, but the apical cells of the tegmina arranged more as in *Ancono* Kirkaldy. Head produced before eyes a little inflatedly, rounded apically. Head and eyes wider than pronotum, the latter arched anteriorly, one-half longer than the head. Tegmina without appendix; only one longitudinal apical vein emitted from the transverse apical veinlets, this forking into three at about its middle, thus forming 4 apical cells. Wings with submarginal vein entire, though faintly marked apicosuperiorly; third vein forked; 2 apical cells.

1. *hanuala*, sp. nov.

Head, pronotum and scutellum sordid testaceous; underside and legs pallid. Tegmina subhyaline, milky; clavus more or less clouded with pale brownish, a milky spot towards the apex; corium more or less clouded with pale brownish basally, a brownish curved line running to apex and giving out 3 brownish lines costally and 2 or 3 clavally, at more or less regular intervals.

Length: $3\frac{1}{8}$ mill.

Hab: Queensland, Brisbane (vi).

Cicadula, Zett.

Cicadula Zetterstedt, 1838, Ins. Lapp., 296; J. Sahlberg, 1871, Not. faun. Fenn., (2), IX, 158.

Kybos & Chlorita, Fieber, etc.

The following species belong by the venation to the group *Chlorita* as figured by Fieber, (1866).

1. *histrionicula*, sp. nov.

Head pale lemon yellow, vertex almost entirely occupied by 2 large subcontiguous subquadrangular blackish spots. Pronotum blackish, lateral margins and sides pale lemon yellow. Scutellum blackish. Sterna, sternites and tergites pale lemon yellow, a spot about the middle and most of the posterior half of the latter (including genital segments) blackish; genital segments beneath greenish, apical ⅔ of pygofers black. Tegmina pale yellow, apical ⅔ of clavus, a patch near the middle of the corium and the exteroapical third of corium, blackish. Wing veins brownish.

Female: Valve deeply narrowly notched, posteriorly rounded on each side of this; pygofers long and narrow.

Length: 2½ mill.

Hab: Queensland, Bundaberg (ix-xii).

2. *vitiensis*, sp. nov.

Lemon yellow, more or less suffused with greenish; vertex castaneous, or sordid yellowish; frons sordid yellowish, a blackish line at anterior margin of head between the eyes and another narrower, curved one near base of frons. Tegmina lemon yellow, suffused with green or with orange, with a brownish black line from apex of clavus to costa curving a little downwards, veins apical to this the same color, first apical vein thickened as regards the color. Underside, large, etc., pale greenish. With veins more or less brownish.

Length: 3 mill.

Hab: Viti Isles (iii).

Eupteryx, Curtis.

Eupteryx, Curtis, 1833, Ent. Mag., I, 192.

The tegmina are unfortunately a little mutilated, but I think the following species may be placed here.

1. *haematoptilus*, sp. nov. (Pl. XXXI, fig. 6.)

Head, pronotum, genital segments, etc., dark, immaculate, blood red, little paler beneath. Eyes black. Scutellum pale luteous. Tegmina subhyaline, more or less tinged with reddish yellow; costal area, apical three-fifths of clavus, a narrow transverse fascia at apical veins, and almost all the veins, more or less blood red; a blackish red spot at the apex of the costal area; the base of the 4th apical area very narrowly, and the apex of the apical areas more or less, infumate. Abdominal tergites blackish, more or less pale reddish in the middle. Underneath (except as above mentioned) and legs pale testaceous. Saw black. Vertex a little narrower at base than an eye, hemispheric, slightly convex, length and breadth equal (measured as far as the ocelli), lateral margins straight, very slightly divergent. Frons very convex, narrowly elongate. Ocellar rudiments large. Pronotum about as wide as head and eyes, lateral margins short. Tegmina elongate, evenly rounded at the apex. Venation on colored part of tegmina very indistinct, there are 4 apical cells the apical parts of 3 corial cells. A diagrammatic sketch of a tegmen is appended, showing that the venation is not similar to any other described *Eupteryx*. Apart from this the species is easily recognized by the coloring and by the big eyes.

Female: Genital segment at least 4 times as long ventrally as the white, ultimate abdominal segment, which is apically truncate.

Length: 4 mill.

Hab: Queensland, Redlynch (vii).

N. B. For *Eupteryx picta* Melichar, (nec Fabricius, Curtis), a Sinhalese species, I propose the name *Eupteryx melichari*, n.n.

Empoa Fitch.

Empoa Fitch, 1851. Hom. N. Y. Cab., 63.

Typhlocyba auctt.

Gillette has evidently wrongly identified *Typhlocyba commissuralis* Stal which belongs to *Cicadula* (typical subg.=*Kybos* Fieber) and has a quite different wing venation to *Typhlocyba* Gillette (i. e. *Empoa*).

E. australensis, sp. nov.

From very like that of *E. rosae* (Linn.) but the head is less angular apically and the pronotal sides shorter. Vertex pale sanguineous with a long line (widening basally) and two irregular wedges near the apical margin (more or less irregularly), a longitudinal line (narrower apically) and the posterior margin), greyish. Scutellum white, a pale orange square on basal two-thirds, apical third with a blackish longitudinal line and a black spot on posterior angle. Tegmina orange, crimson, cinerous, dark brownish and whitish. Basal half of clavus, pale orange with a white spot; apical half whitish, extreme apex faintly orange. Basal third of corium whitish, extreme base sanguineous and orange. Middle third more or less crimson, a whitish spot at its apex; apical cells whitish, the veins and the transverse veins pale cinereous. Underside more or less dark brownish, face paler. Pronotum a trifle longer than the head. Tegmina with four apical cells, the third being sub-parallelsided and oblong. Basal of the apical cells, the veins are more or less obsolescent. Wing venation as in *E. rosae.*

Length: (female) 3¼ mill.

Hab: Queensland, Brisbane (vi).

Erythroneura Fitch.

Erythroneura Fitch, 1851, Hom. N. Y. Cab., 62.

Zygina Fieber, etc.

Typhlocyba (part) auctt.

1. *melanogaster*, sp. nov.

Head sordid-brown, darkening at the anterior margin of vertex, the posterior margin paler. Pronotum creamy, the posterior third (produced medianly forward) greyish; anterolaterally a curved black line on each side. Scutellum more or less sordid yellowish, anterolateral angles widely black. Tegmina subhyaline. Clavus and costal cell pale yellowish brown. Wings iridescent, veins pale brown. Legs pallid. Abdomen black. Vertex about as wide as an eye.

Length: 3 mill.

Hab: New South Wales, Sydney (i.)

2. *lubra* sp. nov.

Pale yellowish, rather sordid; rostrum pale ferruginous. Tergites (except genital segment and narrowly laterally) black. Tegmina hyaline milky, veins pale yellow. Vertex at base wider than an eye.

Length: 3 mill.

Hab: New South Wales, Sydney (i.)

The following three species are typical *Zygina*, having only 3 apical cells to the tegmen.

3. *honiloa* sp. nov.

Pale golden yellow. Eyes blackish. Tegmina apically, etc., more or less hyaline, veins of wings pale yellowish. Head convex, anteriorly rounded, shorter than pronotum. Tegminal veins all distinct.

Male: I think the valve is absent, but the genitalia in the 4 males seen are shrivelled.

Length: 2½ mill.

Hab: Queensland, Bundaberg (ix-xii)

4. *ipoloa* sp. nov.

Pale yellowish cinerous, paler beneath; eyes, and a large spot on the anterior margin of vertex, black, the latter irregularly encircled by a faint brown halo; a transverse brown stripe, widening medianly, on the pronotum close to the posterior margin. Scutellum and rest of pronotum more or less sordid. Tegmina hyaline, costally smoky; wing veins smoky. Abdomen (except the pallid genital segments) more or less pale sordid brownish (male) or brownish black (female). Vertex roundly triangular, about same length as pronotum.

Length: 2½ mill.

Hab: Queensland, Cairns (viii.)

5. *honiala* sp. nov.

Allied to *E. honiloa* but paler and head rounder and blunter. Testaceous, veins pale orange; costal vein more or less pale orange sanguineous.

Length: 3 mill.

Hab: New South Wales, Sydney (i).

Gen. (?) sp. nov.

The wings in both specimens are too far mutilated to fix the genus of this small yellowish form from Sydney (i).

Subfamily Ledrinae.

Characterized by the ocelli being placed on the disk of the vertex; the subfoliaceous or foliaceous posterior tibiae which are tricarinate, and armed anteriorly with strong spines; and the flat (often concave beneath), foliaceous head. All the forms seem to be arboreal.

Ledra Fabricius.

Ledra Fabricius, 1803, Syst. Rhyng., 24.

A number of Australian species have been described, none having however been collected in the imago state by Koebele and Perkins, though nymphs and several species seem to belong here; they resemble the adults somewhat except that they lack the auriform processes on the pronotum.

The following are described from Australia:

1. *Fulgora planirostris* Donovan. (=*Ledra caudata* Walker =*L. valida* Walker, etc.)
2. *L. brevis* Walker. (=*L. australis* Walker.)

? 3. *L. brevifrons* Walker.
? 4. *L. concolor* Walker.
? 5. *L. teliformis* Walker.
? 6. *L. navicula* Walker.
? 7. *L. cuspidata* Walker.

Rhotidus Walker.

Rhotidus Walker 1862 Journ. Ent., I, 318.
=*Rhothidus* Stal, 1865 O. V. A. F., XXII, 157.

This must be rich in species in Australia as Stal has described four and Walker one, while I now diagnose 6 more, none of which can I identify with the former. All the individuals collected by Koebele and Perkins are females and none of them are vaginate, as indicated by Stal and Walker. Ocelli about as far from the eyes as from one another, situated just above apical margin of eyes.

ingens sp. nov. (Pl. XXXI, fig. 8.)

Head-form intermediate between that of *Ledropsis glauca* Mel., & *stali* Mel.; posterior margin of pronotum even less sinuate than in *L. fuscipennis* Mel.

Yellowish cinereous, paler beneath. Eyes dark, ocelli red. Closely and obsolescently irrorate with pallid yellowish. Closely and strongly punctured. Vertex longer than wide, slightly carinate longitudinally, sloping down on each side of this, apical margin narrowly angulate. Rostrum not reaching to base of mesosternum. Anterior margin of pronotum rounded, posterior margin almost truncate at scutellum. Posterior tibiate 4-spined.

Length 12 mill.

Hab: Queensland, Bundaberg (xi.)

2. *informis* sp. nov. (Pl. XXXI fig. 9.)

Very similar to *R. ingens* but vertex shorter and more pointed apically.

Length: 10 mill.

Hab: Queensland, Nelson (vii.)

3. *flavomaculatus* sp. nov. (Pl. XXIV, figs. 1-4.)

Very similar in shape to *R. ingens* but not quite so large or broad.

Orange-brown, closely spotted all over vertex, pronotum, scutellum and tegmina with yellowish. Underside testaceous, reddening a little on frons laterally. Abdomen above more or less suffused with sanguineous.

Length: 12 mill.

Hab: Queensland, Bundaberg (xi.)

A nymph with greatly elongate head (Koebele's No. 2297) probably belongs to this.

monstrum, sp. nov. (Pl. XXXI, figs. 5 and 10.)

Similar to *B. flavomaculatus* but much narrower and the tegmina are suffused with rosy, and not spotted with yellow.

Length: 10¾ mill.

Hab: Queensland, Nelson (vii), Cairns (viii.)

Nymphs are dirty brown, obscurely marked with black.

5. *ledropsiformis*, sp. nov. (Pl. XXXI, fig. 11.)

Similar to *R. informis*, the head being shorter and a little less acute.

Length: 8¾ mill.

Hab: Queensland, Brisbane (xi).

6. *horrendus*, sp. nov. (Pl. XXXI fig. 13.)

Pale olive brown, mottled on head and pronotum with pale olive green. Scutellum pale greenish. Vertex shorter than pronotum, former obtusely angulate.

Length: 6½ mill.

Hab: Queensland, Kuranda (viii.)

7. *viridescens*, sp. nov. (Pl. XXXI, fig. 12.)

Dull green, head tinged with yellowish, pronotum and tegmina more or less obscurely mottled with yellow. Vertex about the same length as the pronotum or a trifle longer, apically rounded.

Length: 7¼ mill.

Hab: New South Wales, Sydney (ii.)

A nymph from Mittagong (1) closely resembles this.

Other described species are:

8. *R. cuneatus* Walker 1862 Journ. Ent. 1, 319, Pl. XV, fig. 5, (not "6" as in text.) Queensland, Moreton Bay.
9. *Rhothidus navicula* Stal. 1865 O. V. A. F. XXII, 157.
10. *R. convivus* Stal. l. c., Moreton Bay.
11. *R. leucostictus* Stal. l. c., N. Australia.
12. *R. breviceps* Stal. l. c., S. Australia.

Subfam. Stenocotinae.

This subfamily is characterized by the peculiar shape of the vertex and by the ocelli being placed in cavities on the anterior margin (viewed dorsally) of the head; the posterior tibiae are quadricarinate with 6 strong spiniferous spurs on the outer margin, shortly but strongly spined on the upper margin, and feebly bristled on the others.

Stal includes this in his heterogeneous Ledrina, the typical form of which however has the ocelli on the disk of the vertex. To the Stenocotinae belong *Stenocotis* Stal., and two new genera, viz: *Smicrocotis* and *Kyphocotis*; the general venation is that of *Ledra*.

1. Scutellum plane....................................2
1a. Scutellum acutely cristate.........3 *Kyphocotis*, gen. nov.
2. Vertex somewhat re-curved......2 *Smicrocotis*, gen. nov.
2a. Vertex plane............................1 *Stenocotis*, Stal.

All the forms are arboreal.

Stenocotis Stal.

Ledra (part) Walker 1851 List. 809-30.

Stenocotis Stal. 1854 O. V. A. F. XI, 254; and 1856, op. c., XIII, 67, (type *subvittata* Stal.)

Head short, flat, horizontal, anterior margin obtuse-angularly produced, acute, carinate, the keel forking on each side of the middle and reuniting nearer the eyes, thus enclosing a short, narrow, suboval area in the middle of each anterolateral margin, in which the ocelli are placed. Posterior margin angularly emarginate, the middle of the pronotum anteriorly much anterior to the apical margin of the eyes. Eyes oblique, reniform, longer than wide, extending laterally farther than the pronotum. Vertex longitudinally striate, pronotum transversely so, but anteriorly sublongitudinally. Scutellum transversely striate. Frons slightly convex, antennal ridges not deep, lorae and clypeus elongate. Pronotum about as long as wide, much longer than the vertex medianly, flat in front, raised posteriorly, lateral margins straight, subparallel, posterior margin obtusely emarginate. Tegmina extending farther posteriorly than the abdomen in the male, not so far in the female; clavus with the usual veins and also with some transverse veins connecting axillary with commissure and one connecting anal with the suture near the apex. In the corium, the medioradial forks near the base, the median being joined almost immediately to the cubital by a transverse vein. There are 5 discoidals of which two are subbasal and 3 subapical. There are a number (at least 10?) of apical cells, all much longer than wide, in some species many of them forked and many divided transversely. Tibiae dilated.

A number of species have been described by Stal and Walker, but there are probably several synonyms among them, as the sexes are apparently dissimilar. The specimens collected by Koebele and Perkins seem to belong to *S. planiuscula* Stal. made.

1. *planiuscula* Stal. (Pl. XXV, figs. 3-8.)

Stenocotis planiuscula Stal. 1854 O. V. A. F., XI, 254.

Nymph: In my own collection, I have 3 examples, from Victoria, of nymphs that I doubtfully refer to the same species; they at least belong to this genus. The whole insect is very flat, the head is enormously arched, the anterior margin of the vertex being roundly angular. Just above the eye, it is deeply emarginate, forming a spine. Vertex longitudinally sulcate, base obtusangularly emarginate. The frons apically and apicolaterally somewhat widely foliaceous, rostrum reaching to apex of posterior coxae.

The other described forms, all from Australia, are:

2. *Ledra corticalis* Walker, 1851, List. 814.
3. *L. ferruginea* Walker op. c., 817 (Tasmania.)
4. *L. depressa* Walker, l. c., (Tasmania, South Australia)
(=*Stenocotis subvittata* Stal. 1854 O. V. A. F., XI, 254.
(=*Ledra delineata* Walker 1858 Suppl., 250.)
5. *Ledra varia* Walker, 1851, List, 819 (Tasmania.)
5. *L. costalis* Walker, op. c., 821.
7. *L. claudenda* Walker, 1858, Suppl., 359 (Queensland.)

Smicrocotis gen. nov.

Allied to the preceding, but the head is somewhat recurved, the frons more convex and the striation on head and pronotum much coarser, the venation different, etc.

Vertex very narrow, the basal margin not so emarginate as in *Stenocotis*, apical margin only slightly arched, recurved, the longitudinal (suboblique) striations very coarse; ocellar grooves shorter and rounder; frons more convex, antennal ridges thicker. Pronotal striations coarser. Tegmina with 5 discoidals (2 basal and 3 subapical; the latter quite different.)

1. *obscura*, sp. nov.

Dark brown, irrorated with black (which forms several more or less distinct longitudinal lines on the pronotum.) Frons basally blackish brown. Tegmina pallid, mottled closely with brown and brownish black.

Length: 10 mill.

Hab: Queensland, Cairns (viii.)

Nymph: (?belonging to this genus.) Head produced in front, then diverging rapidly posteriorly, longitudinally carinate, spinosely produced just above the eye. Posterolateral angle of pronotum spinose.

Hab: New South Wales, Sydney (ii.)

Kyphocotis, gen. nov.

Closely allied to *Stenocotis* but the posterior three-fifths of the scutellum are elevated in a narrow, acute crest, which in profile is more or less rounded.

(1. *tessellata*, sp. nov. (Pl. XXV, figs. 1-2.).

Dark brown, more or less tessellated and marmorated with pale golden and pale brown; apico-exterior third of tegmina subhyaline, more or less cinerous. Femora annulated with black. Vertex a little recurved, very narrow.

Male unknown.

Female valve as in *Stenocotis*.

Length: 12 mill.

Hab: Queensland, Bundaberg (xi.)

Subfam. Kahavaluinae.

Kahavalu, gen. nov.

This seems somewhat near *Ulopa* Fall (a Membracid) on the one hand and *Megophthalmus* Curtis, on the other. It is distinguished by the ocelli being each in a groove on the rounded anterior margin of the vertex; the pronotum very slightly sinuate posteriorly, not carinate and no process; scutellum free. Head pronotum, scutellum, clavus etc., deeply and closely punctured, making them rugose, a shining point at the bottom of each puncture. Vertex short, transverse, flattened, except at the lateral angles. Eyes large, not forming part of the curve of the head. At the anterior margin of vertex there are two elongate grooves, reaching almost to the eye laterally, but not touching medianly. At the extreme interior part of each of these is an ocellus. Frons rather narrow, elongate, slightly convex, lateral margins gently rounded; antennae in a deep groove near the base. Clypeus not carinate.

1. *gemma*, sp. nov.

Black; the punctures with a sparkling point at the bottom. Cells of the tegmina hyaline.

Hab: New South Wales, Sydney (i).

Length: 2⅞ mill.

Fam. 2. Membracidae.

This family which contains, or rather consists of, forms that are among the most bizarre of all the Hemiptera, was briefly tabulated generically by Stal in 1868. The Australian forms were well monographed by Goding two years ago, but unfortunately about the same time, Buckton published a large work, entitled "A monograph of the Membracidae."[*] which is simply an unsystematized account of the forms he had seen and is in many parts a needless and costly re-hash of Fowlers' work in the 'Biologia Centrali-Americana.'

With very few exceptions, all the Australian Membracids appear to be Centrotine. The family is, as pointed out by Stal and later by Hansen, certainly Tetigonioid (probably via forms related to the *Agalliinae*, via *Aethalion*) and the majority of authors are assuredly wrong in placing them between Fulgoridae and Cicadidae (with neither of which families have they any connection, except that they are all trimerous) and removing them from the vicinity of the Tetigonioidea, their rightful position. There is a single (introduced) Hawaiian species, probably a *Centrotypus*. The males are often appreciably smaller than their females.

I have determined 8 genera and 16 species, of which, I suppose one genus and nine species to be undescribed; there are also a number of small species, probably near *Centrotypus*, that I cannot satisfactorily identify generically at present and have left undone until further opportunity for work or some material for comparison is at hand. The Centrotinae are very difficult to work out, and the difficulties have not been lessened by Buckton's work.

Gelastorrhachis gen. nov.

Allied to *Eutryonia* Goding[**], but differs by the following characters:

Pronotum much less widened posteriorly and is mediolongitudinally *strongly carinate* throughout its entire length (including processes), not sulcate; anterior process much more highly elevated and differently shaped, posterior process about as long in *Eutryonia* but follows the curve of the tegmina and its tip is contiguous with them. Venation different. Type *diadema*.

There are two species:

1. Lateral forking of the anterior process of the pronotum extending beyond the rest of the width of the insect.......... ....*diadema*, sp. nov.
2. Pronotal process bulbous at its tip, lateral processes small..............................*clavata*, sp. nov.

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[*] I am much indebted to Mr. D. L. Van Dine for procuring me the loan of this work, from the library of the Division of Entomology at Washington. Since the above was in print, I have learnt of the death, at an advanced age, of Mr. Buckton, and consequently have modified my original remarks on his work.

[**] 1903 P. Linn. S. N. S. W., XXVIII, 6 Pl. 1, fs. 10 and 11 (not 22 which refers apparently to *Eufrenchia*). The venation of f. 26 does not accord with that of f. 10.

1. *diadema*, sp. nov. (Pl. XXX, figs. 2 and 3.)

Furnished with yellow pubescence; piceous brown, anterior process of pronotum and posterior half of posterior process threaded with reddish; pronotal keels mostly reddish; anterior half of posterior process pale flavous. Beneath blackish, legs pale yellowish fulvous. Tegmina ferruginous, paler apically; clavus more or less hyaline, iridescent medianly, a small hyaline spot near the apex.

Length: (female) 5 mill; height 4¾ mill; width across processes, 2 mill.

Hab: Queensland, Kuranda (viii) on a tropical tree.

2. *clavata*, sp. nov. (Pl. XXX, figs. 4-5.)

Color as in *G. diadema* but legs ferruginous. Pronotal process slightly bulbous at the tip, with a short acute spine on each side of the bulbous part.

Length: (female) 5 mill; height 4 mill; width across pro cesses 1¼ mill.

Hab: Queensland; Kuranda (viii.)

Zanophara Kirkaldy.

=*Daunus* Stal 1866 Hem. Afr. IV, 87; Goding 1903 P. Linn. Soc. N. S. W. XXVIII, 30; Buckton (par?)

=? *Ceraon* Buckton 1903 Mon. Membrac, 228.

=*Zanophara* Kirkaldy 1904, Entom. XXXVII, 279.

1. (?) *tasmaniae* (Fairmaire).

Centrotus tasmaniae Fairmaire 1846 Ann. S. E. France, IV. 513, Pl. 3, f. 15.

Daunus tasmaniae Goding 31 pl. 1, fs. 6 and 20 (tegmen and nymph).

? *Centruchoides tasmaniae* Buckton 1903 Mon. Membr. 227 pl. 227, pl. 1, f. 6.

A single female from New South Wales, Mittagong (1), arboreal, which I refer somewhat doubtfully to this; Fairmaire's type was from Tasmania. Buckton's *Centruchoides tasmaniae* sp. nov., from Victoria is either this or a new species of slightly paler color.

2. (?) *vitta* (Walker).

Centrotus vitta Walker 1851 List. Hom. 626.
Daunus vitta Goding, 32 Pl. 1, f. 25 (Tegmen).
? *D. decisus* (part) Buckton 225, pl. 1, f. 1.

A single example from Queensland, Bundaberg (IX-XII), which is probably this; the ocelli are however practically equidistant, a little more remote from one another if anything, while Goding says they are much nearer in *C. vitta*. This is also arboreal.

Buckton's *Ceraon* is perhaps identical with Stal's preoccupied genus *Daunus* and my *Zanophara*; his *Daunus* is a mixed assemblage, one species of which possibly belongs to *Ceraon*.

Sarantus Stal.

Sarantus Stal 1863 Tr, E. S. London (3) I, 592.

1. *nobilis*, sp. nov.

Pitchy, with yellowish pubescence; veins of tegmina apically and legs dark ferruginous; eyes yellowish. Tegmina vitreous with a slight yellowish tinge. Horns very sharp, bases remote, subperpendicular, directed slightly forward and outward, posterior process flat. Two subapicals elongate, the outer very little shorter than the inner.

Length: (female), 9 mill.

Hab: Queensland, Cairns (viii.)

Differs from *S. wallacei* Stal, by the legs not being pallidly annulate and the horns more perpendicular and shorter.

Terentius Stal.

Terentius Stal 1886 Hem. Afr. IV 87.

1. *convexus* Stal.

T. convexus Stal. 1869 O. V. A. F. p. 286.
Hab: Queensland, Kuranda (viii), Cairns (viii) arboreal.
N. B.: Tarsi pale sordid flavous.

Dingkana Goding.

Dingkana Goding 1903 P. Linn. S. N. S. W. XXVIII, 8.

1. *borealis* Goding.

D. borealis Goding op. c. 9, pl. 1, f. 21 (tegmen).

Hab: Queensland, Cairns (viii), Nelson (viii), Kuranda (viii) arboreal.

The venation is variable, even in the tegmina of the same individual; the third subapical cell is sometimes divided, and there may be also two or more small supplementary cells.

Sextius Stal.

Sextius Stal 1866 Hem. Afr. IV, 88.

A genus of greenish forms, with the apical parts of the tegmina reticulate. The males are as a rule smaller, and the pronotal horns less developed. All the species are *Eucalyptus*-feeders.

The following species are all, I think, good, but difficult to define verbally. The following key may help to their identification:

1. No basal cross vein (sec. Goding).......*depressus* Goding.
1a. A basal cross vein..................................2.
2. Pronotum more or less swollen near the anterior margin ....*kurandae*, sp. nov.
(2a). Pronotum anteriorly practically flat medianly..........3.
(3). Posterior process extending beyond tegmina........ .... *longinotum* sp. nov.
(3a). Posterior process not extending as far as apex of tegmina. ....*bipunctata* (Fabr).
(4a). Tegmina immaculate. ....5.
(5). Horns feebly developed.................*bipunctata* vars.
(5a). Horns well developed...............................6.
(6). Horns and pronotum between them dark, pronotum anteriorly pale, tegmina sparsely marked with black.. ....*assimilis* sp. nov.
(6a). Horns and pronotum anteriorly dark, tegmina immaculate. .... *virescens* (Fairm.)

N. B. *Sextius virescens* Buckton 228, Pl. 31, f. 3, is impossible to determine, being probably a mixed species.

1. *depressus* Goding.

S. depressus Goding 12, Pl. 1, f. 24 (nymph).

Recorded from Queensland, West Australia, and several localities in New South Wales. This species is distinguished by the absence of a cross vein near the base of the tegmen. I have not seen it.

2. *bipunctata* (Fabricius).

Membracis bipunctata Fabr. 1775 Syst. Ent. 677.
Sextius bipunctata Goding 12.

I think I have identified this correctly from a single specimen from Queensland, Cairns (viii); Fabricius' type was doubtless discolored. There are also specimens from Cairns (viii) and Kuranda (viii) apparently identical except that the black spots are absent. Also other specimens from Cairns (viii) and Bundaberg (11) which I place at present with this species, but which have the lateral horns turned a little forwards.

Length: (female) 7⅓-7¾ mill; width across horns 2¼-3⅓ mill.

What are probably the males (Cairns viii), are only 5½ mill long, with less developed horns.

3. *virescens* (Fairmaire).

Centrotus virescens Fairmaire 1846 Ann. S. E. France IV. 515.
=*Ceresa suffusa* Walker 1851 List, 530.
=*Sextius virescens* Goding, Pl. 1, f. 2 (tegmen).

Some examples from New South Wales, Sydney (i-ii), apparently belong to var. *suffusa.*

Length: 6½ mill; width 3½-3¾ mill.

I do not think that *S. depressus* is distinct from this.

4. *assimilis* sp. nov.

Close to *S. virescens* but a little larger and broader, the horns are distinctly more elongate and less blunt and are less arched before the downward turn near their apex. The horns, and the pronotum between them, are dark, but while in *S. virescens* the same thing occurs, in that case the whole of the pronotum anteriorly is dark, while in *S. assimilis* it is only a band, the anterior part being pale. In *S. virescens* also the tegmina are immaculate, in *S. assimilis* the veins are more or less sparsely marked with black.

Length: (female) 7½ mill; width 4¼ mill

Hab: New South Wales, Sydney (i).

5. *longinotum* sp. nov.

Allied to *S. virescens*, but the posterior process extends slightly beyond the apex of the tegmina; in all other species it is not extended as far. The horns as in *S. virescens* but less blunt and not turned backwards so much. The reticulation of the tegmina extends partly into the subapical cells. The pronotum between the horns (including them) is dark, the rest anteriorly being pale.

Length: (female 6½ mill width 3¼ mill.

Hab: Queensland, Nelson (viii).

6. *kurandae*, sp. nov.

Allied to the immaculate form of *S. bipunctata* but much slenderer, the horns a trifle less pronounced, the anterior margin of the pronotum (viewed in front) narrowly, somewhat deeply impressed, the pronotum immediately posterior to this medianly swollen a little (practically flat in the other species). The tegminal reticulation extends into the subapical cells.

Length: (female), 6½ mill width 2½ mill.

Hab: Queensland, Kuranda (viii.)

Acanthuchus Stal 1866 Hem. Afr. IV, 87; *Acanthucus* Goding 6 and 13.

1. *dromedarius* sp. nov.

Allied to *A. kershawi* God., but the horns are larger and the clavus not entirely opaque, etc. Dark ferruginous, with bright yellow pubescence. Eyes yellow. Tegmina subhyaline, yellowish apically; costal cell, base of radial cell and of clavus opaque ferruginous with yellowish pubescence, veins yellowish ferruginous with yellowish pubescence. Legs yellowish and ferruginous. Pronotal horns large, extending beyond lateral margin of body. Disk posterior to this is roundly obtusangulately elevated and again elevated roundly at about the middle of the tegmen (not touching the latter in the middle); posterior process does not nearly reach the apex of the tegmina. Two subapical cells, the exterior nearly circular, not nearly reaching exterior margin of tegmen; third apical elongate.

Length: 4¼-4½ mill; width 2¾ mill.

Hab: Queensland, Cairns (viii.)

2. *obtusus*, sp. nov.

Allied to the preceding, but the posterior process distinctly angular, not so broad. Dark ferruginous, with pale yellowish-grey pubescence; base of tegmen and the entire costal cell, veins, etc., more or less dark ferruginous. Horns rather larger at the bases more contiguous, posterior process not so elevated posteriorly. Externor subapical cell subhemispherical; base of third apical cell curved inwards on the outer side.

Length: (female) 4½ mill, width, 3 mill.

Hab: New South Wales, Sydney (i).

Centrotypus Stal.

Centrotypus Stal 1866, Hem. Afr., IV, 88; Goding 26.

I think this genus runs gradually into *Acanthuchus* and that *Sertorius* is a synonym also.

1. *hospes*, sp. nov.

Black with yellowish pubescence. Scutellar tufts prominent, pale yellow. Tegmina vitreous, veins dark, or pale, ferruginous. Legs more or less ferruginous, intermediate and posterior tibiae with apical half yellowish. Horns slight, acuminate turned directly outward, very slightly upward and backward, bases remote. Exterior subapical cell elongate, suboval.

Length: 8 mill, width, 4¾ mill.

Hab: New South Wales, Sydney (i).

The following Membracidae, not included in Goding's Monograph, have been recorded from Australia. Their identification is doubtful without access to the types.

1. *Philya parvula* Buckton 1901, Mon. 57, Pl. 8, fig. 4, is I think, my *Phrynomorphyes parvula*, a Tetigoniine, and has nothing to do with *Philya*.
2. *Oxyrhachis neglectus* Buckton 1903 Mon. 224, Pl. 49, fig. 5. South Australia. Probably not an *Oxyrhachis*.
3. *Daunus succisus* Buckton 226, Pl. L, fig. 3. South Australia. Not a *Daunus*.
4. *Ceraon tumescens* Buckton 229, Pl. 51, fig. 1. Tasmania.
5. *C. contortus* Buckton 229, Pl. 51, fig. 2. Tasmania (?).
6. *Pterosticta rubrilinea* Buckton 230, Pl. 51, fig. 4.
7. *P. spreta* l. c., fig. 5.
8. *P. rubridorsata* l. c., fig. 6.
9. *P. xantha* Buckton 231, fig. 7.
10. *P. interposita* l. c., Pl. 52, fig. 1.
11. *Ibiceps falcatus* Buckton 239, Pl. 54, fig. 6.

16. *Sphaerocentrus luteus* Buckton 244, Pl. 56, fig. 6. All seven from S. Australia. Probably not a *Sphaerocentrus*, possibly an *Acanthuchus*.

Family 3 Cercopidae.

I have not had sufficient material before me to make many researches on this comparatively small family, of which I now describe 8 new genera, and 9 new species. I think however that Stal's subfamilies are founded on characters of convenience, not of real scientific value, for example: *Aufiterna* has the anterior margin of the pronotum straight, but it seems to me to belong really nearer *Polychaetophyes*, *Ptyelus*, etc. Moreover in some genera the anterior margin of the pronotum is so slightly curved, as to be almost straight.

Cercopidae are apparently not of very extensive occurrence on the Australian Continent, their headquarters lying in Central and South America and in the Oriental Region and the Malayan portion of the Australian; they have members however in every Zoological Subregion except the Hawaiian.

As is the case with many other of the older Hemipterous genera, *Cercopis* Fabricius has been employed at different times for many diverse forms. Stal (1869, Svensk. Vet. Akad. Handl., 8 no. 1, p. 11), fixes *carnifex* Fabr. as the type; it had however already been fixed as "*spumaria* Linn." by Latreille. *C. carnifex* is an Australian species unknown to me, and I do not even know to what genus it now belongs. Stal, in the work above cited, alters his *Cercopis* of the "Hemiptera Africana" (1866) to "*Cosmoscarta*," but does not redefine *Cercopis* (Fabr.) Stal: later, he adds *ferruginea* (Walker) from an unknown locality.

C. '*spumaria* Linn.', moreover, is not definitely known. Horvath (1899 Revue d'Entom. XVII (for 1898) 275) examined the Linnean types and found the first specimen to be *Aphrophora alni* (Fallen), the second *Philaenus spumaria* Auct., and concludes that the former fits the Linnean diagnosis better, as that notes "habitat in Salice." This however is not stating the case quite accurately; Linne writes (1758 Systema Naturae Ed. X, 437.) "Habitat in Europae Plantis variis, frequens in Salice viminali, latitans intra spumam," but as *spumaria* of later Catalogues never is found on *Salix*, I think Horvath's view must be sustained; this is the view also of Germar, Dufour, Burmeister, Rambur, Amyot and Serville, etc.

The following synonymy will elucidate this:

Genus 1. *Cercopis* Fabricius 1775, Latreille, etc.
=*Aphrophora* Germar, 1818.
type *Cicada spumaria* Linn., Latr., =*Cicada alni* Fallen.
Genus 2. *Philaenus* Stal 1864.
=*Cercopis* Kirkaldy 1901.
type *Cicada leucophthalma*, Linn., =*spumaria graminis* DeGeer, =*spumaria* of most later authors.

It may be noted here that authors refer constantly to *Aphrophora salicis* DeGeer. There is no such species; DeGeer described a form as *Cicada spumaria salicis*, an inadmissible term, and the species should be known as *Cercopis rustica* Fabricius.

There are 3 conventional subfamilies as follows:

(1). Rhinaulacinae (=Cercopinae of some authors) with about 25 genera.
(2). Cercopinae (=Aphrophorinae of some authors) with about 36 genera, and
(3). Machaerotinae, with 2 genera.

(Of *Embolonia* Provancher 1889, I have not seen the description and it is not mentioned by Goding or Ball.) These subfamilies are separable as follows:

1. Anterior margin of pronotum straight.......*Rhinaulacinae.*
1a. Anterior margin of pronotum rounded or angulate......2.
2. Scutellum flat, triangular......................*Cercopinae.*
2a. Scutellum strongly elevated, armed with a long apical spine. .... *Machaerotin*e.

But as noted above, this is a classification of convenience.

Subfam. Rhinaulacinae.

Euryaulax, gen. nov.

General appearance of *Phymatostetha* Stal. Vertex declivous, flat, longitudinally sulcate exterior to the ocelli, the sulci being parallel and the space between being about equal to that between a sulcus and the nearest eye; the middle lobe is divided by a transverse sulcus into two parts, the anterior being about half the length of the posterior (*).

The vertex is also narrowly, transversely impressed close to the posterior margin. The entire anterior (dorsal) margin of the head is strongly, acutely, carinate. The frons is pitted at its base and is strongly swollen, transversely striate, somewhat deeply and widely longitudinally impressed for at least two-thirds of its length, the sides of the impression forming slight but noticeable keels. Pronotum with 2 submedian lachriform impression near the anterior margin; posterior lobe obsolescently sulcate longitudinally. Scutellum also medianly impressed. The characters of venation, etc., are much those of *Tomaspis* Am. Serv. Legs normal. Antennae reaching laterally to about the intero-lateral margins of the eyes.

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* It is possible that this middle lobe of the vertex is really a dorsal part of the frons.

E. callitettigoides, sp. nov.

Head, anterior half of pronotum, scutellum, shoulders and a transverse fascia on tegmina, underside, etc., sanguineous, posterior half of pronotum, eyes, tegmina (except as above), antennae, tarsi, anterior tibiae (except basally) and the apical parts of posterior tibiae, etc., black or blackish.

Length: (Female) 7½, (male) 8½ mill.

Hab: Queensland, Cairns (male, viii), Kuranda (female viii.)

The subapical red band on the tegmina is broader in the female than in the male.

Aufidellus, gen. nov.

Apparently close to *Aufidus* Stal, but the pronotum posteriorly is almost evenly rounded and the costal margin is not arched basally.

A. *australensis*, sp. nov.

Yellowish-brown with pale yellowish pubescence. A small spot at the antero-interior angle of the lateral lobes of the vertex, the posterior margin of the vertex, as far as and including the ocelli, the posterior margin of the pronotum narrowly, lateral margins of scutellum narrowly, a transverse band at nearly one-third of the length of the tegmina, the tegmina veins mostly (except the costa), antennal peduncle, lateral margins of abdomen more or less, wing veins mosly, etc., black. Basal third of tegmina subcoriaceous, punctured, yellowish brown, rest hyaline. Middle lobe of vertex a little wider anteriorly than posteriorly, wider than lateral lobe, not sulcate transversely. Frons widely and somewhat deeply channelled (male) somewhat shallowly (female). Posterior tibiae with one spine about the middle. Tegmina with 2 discoidals, 4 apical areas and a stigma.

Length: (Male) 6¼-6⅓ mill; (female) 7 mill.

Hab: Queensland, Kuranda (viii), Cairns (viii.)

Aufiterna, gen. nov.

Allied to *Aufidus* but tegmina more coriaceous and venation different. Pronotum anteriorly with 2 naked callose spots. Posterior margin emarginate, while it is truncate in *Aufidus*. In the tegmina there are 3 discoidals (subapical), 4 apicals well-marked, while there are another 5 small cells marked off on the costal cell. There is a narrow appendix. This genus seems to me more allied to *Polychaetophyes* and other Cercopine genera than to most Rhinaulacine forms.

1. *ptyeloides*, sp. nov.

Brownish testaceous, with paler pubescence; ocelli red. Apical half of tegmina hyaline. Beneath testaceous, lateral margins of abdomen more or less sanguineous. On the costa about the middle of the wing and extending inwards a little is a dark-brown smudge.

Length: 5-5¼ mill.

Hab: Queensland, Kuranda (viii.)

Petyllis, gen. nov.

Allied to *Aufiterna* but vertex short, frons more tumid and more lightly channelled, laterally strongly striate transversely. Pronotum with 8 naked callous spots in a line near the anterior margin, lightly and narrowly sulcate medio-longitudinally. Tegmina coriaceous, 3 discoidal (subapical, and 4 apical)costa with many cells anteriorly), two of the apical veins forking near the apex.

1. *australensis*.

Brownish testaceous, with yellowish pubescence. Apical part of vertex and basal part of frons black, rest of vertex reddish; ocelli reddish. Pronotum tinged in places with reddish. Tegmina with 2 faint, somewhat broad whitish transverse bands. Wing nervures pallid.

Length: 7¾ mill.

Hab: New South Wales, Mittagong (i).

The following forms have been recorded from the Australian Continent, but are unknown to me.

Gen. *Tomaspis* Amyot & Serville 1843 Hemipteres 560.

1. *Triecphora maculata,* Walker 1851 List. Hom. 673, W. Australia.
2. *T. inconstans,* Walker l. c.

Gen. *Cosmoscarta* Stal 1869 K. Svensk Akad. Handl., 88 No. 1, p. 11.

1. *C. australis* Butler 1874 List. Ent., 251, Pl. VIII, fig. 12.

(=*Cercopis urvellei,* Walker); also from New Guinea.

Gen. uncertain?

1. *Cercopis carnifex,* Fabricius 1775 Syst. Ent., 688.
2. *Cercopis mirabilis,* Blanchard (in error?).

Subfam. Cercopinae.

Eurycercopis, gen. nov.

Head flat or slightly concave, triangularly produced in front, apex rounded (lateral lobes acute apicallly, not reaching nearly as far as median lobe), a little longer than pronotum medianly. Eyes much longer than broad, a little oblique. Ocelli obsolete, their rudiments about as far from one another as from the eyes. Frons elongate, convex, first segment of rostrum longer than the second. Vertex and pronotum not carinate, or at least very obsolescently, frons not carinate nor sulcate (or not noticeably so.) Pronotum 5 (or 7) sided, anterior margin rounded, very short (and slightly diverging) posterior to the eyes; posterolateral margins roundly emarginate, posterior margin deeply, almost rectangularly emarginate. Scutellum longer than wide. Tegmina convex, costal margin rounded, apex angularly rounded, apex angularly rounded; corium without a membrane, clavus apically acuminate. Wings with supernumerary cell, anal vein forked near the base. Posterior tibiae bispinose.

1. *nigrofasciata,* sp. nov.

Brown or yellowish brown, closely and finely pubescent (yellowish.) Frons blackish brown. Pronotum, scutellum and tegmina with more or less regular small black spots. Basal third of corium more or less blackish (except at extreme base), and a blackish fascia a little apical of the middle exteriorly to commissure of clavus; another fascia nearer the apex, broken in the middle. Legs more or less blackish brown.

Length: 8¼ mill.

Hab: Queensland, Nelson (vii.)

This is evidently closely allied to *Liorhina* Stal, but the ocelli in the latter are functional, the tegmina more reflexed, the wing neuration a little different, pronotum less emarginate posteriorly, etc. Stal has drawn the anterior margin of the pronotum incorrectly—making it truncate, whereas it is arched.

Philagra, Stal.

Philagra, Stal 1862 Trans. E. S. London (3) I, 592; and 1866 Hem. Afr. IV, 68; Matsumura 1903 J. Sapporo Agr. coll., II, 21.

Chalepus Walker 1851 List. Hom., 731.

Distinguished from all the other Cercopidae by the acuminately produced head.

1. *parva* (Donovan).

Fulgora parva Don., 1805 Ins. New Holl., Hem. Pl. I, f. 2.
=*Chalepus teliferus* Walker 1851 List. Hom. 731.
=*Rhaphirhinus* (?) *parvus* Walker, id. cit., 805.
=*Chalepus pugionatus* Stal. 1854 O. V. A. F., XII, 251.
=*Philagra parvus* Stal. 1866 Berlin Ent. Zeit., X, 386.

Hab: Queensland, Kuranda (viii), Nelson (vii), Bundaberg (ix-x), and Brisbane (vi); on *Casuarina*; also recorded from New South Wales.

The males are a little smaller than the females (males, 8¾-10¾; female, 11-12 mill. long). The two males from Kuranda have the cephalic prolongations a little more turned up, and may be specifically distinct. The colours and patterns are very fairly constant. The species, as noted in the introduction, is a froth-producer in the nymph stages.

Polychaetophyes, gen. nov.

Allied to *Hindola* Kirkaldy. Vertex almost vertical, very short, transverse. Ocelli much nearer to one another than to the eyes. Frons perpendicular (at apex) to the vertex, at base about one-third of the width of the vertex, broadening out a little towards the middle tumid, somewhat lightly roundly impressed near the base (as seen ventrally, (the actual basal part is on the dorsal part of the head.) Antennal peduncle short and small, antennal ridges somewhat deep. Clypeus reaching to apex of anterior coxae. Rostrum reaching beyond base of middle coxae. Pronotum roundly declivous, transversely striate, wider than head and eyes, posterior margin deeply roundly excavated in the middle. Scutellum much longer than wide, posteriorly acuminately produced. Tegmina subhyaline, strongly punctured especially on clavus, with scattered granules on the veins, apical margin of clavus *obliquely truncate* (or, if the claval appendix be not counted, *acute*, not acuminate), membrane (and clavus apically) with an appendix. Wings with the anal vein forked near the base. Legs very short, especially the posterior femora; posterior tibiae with one long, acuminate spine about the middle of outside edge and one tiny subbasal acute spine.

1. *serpulidia*, sp. nov. (Pl. XXXIII, figs. 12 and 13. Pl. XXVII, fig. 9. Pl. XXX, fig. 9.

Pale yellowish brown suffused with reddish. Pronotum yellowish with greenish and reddish tinges. Scutellum reddish, obscurely pallid in the middle and posteriorly. Anterior and interior legs more or less dark, posterior legs more or less pale. Tegmina subhyaline, colorless; basal third of corium and clavus and apex of clavus dark brownish (more or less ruddy), apical fourth yellowish brown. Granulations dark brown. Pronotum very lightly carinate longitudinally; much wider than head and eyes. Scutellum shallowly channelled along its anterior three-fourths, posterior fourth carinate.

Length: 6¾-8 mill.

Hab: Queensland, Bundaberg (xi.)

There is also a female (8 mill.) from the same locality and time of capture, which differs only by having an almost continuous fascia across the tegmen instead of the short wedge at the apex of the clavus. A bred specimen (2306 K) is immature, but there is little doubt that it is referable to this species. The nymph-cases are whitish, often tinged with purplish-red. (Pl. XXIII, f. 12 and 13). (No. 2306 consists of seven on a single twig). They are elongate-subconical, more or less porrect, or with a slight curve, widening gradually from the base.

Length when full grown 11-16 mill., width at mouth 3-3½ mill. See the introduction for remarks on these cases.

2. *aequalior*, sp. nov.

Similar to *P. serpulidia* but pronotum smaller and very little wider than head and eyes; pronotum punctured (not striate). Tegmina punctured but veins not granulate. Dorsal part of frons more swollen, wider anteriorly.

Yellowish brown, frons with black, transverse subparallel lines. Legs, etc., more or less black. Clavus and corium basally coriaceous, apically more membranaceous, medianly colorless (except veins).

Length: 7 mill.

Hab: Queensland, Bundaberg (xi.)

Pectinariophyes, gen. nov.

Closely allied to *Polychaetophyes*, but with the posterior margin of the head raised, pronotum much less declivous, also much longer in proportion to the head. Ocelli farther apart, frons more swollen.

1. *pectinaria*, sp. nov. (Pl. XXVII, fig. 8.)

Yellowish, vertex tinged with red. Eyes dark. Frons transversely lined narrowly with blackish. Posteriorly legs more or less dark. Pronotum but little wider than head and eyes, punctured, scarcely striate. Scutellum flat, not carinate or channelled. Tegmina punctured, not granulate.

Length: 5 mill.

Hab: Queensland, Bundaberg (xi, bred, Koebele's No. 2307).

One specimen, unfortunately rather immature. It has been described only to connect with the pretty nymph cases which smaller and slenderer than those of *Polychaetophyes*, smoother in texture, and of much finer workmanship. They are pale-yellowish brown and are fastened to twigs by twos and threes.

Length: 13 mill.; width of mouth, about 2 mill.

Anyllis, gen. nov.

Distinguished by the interior vein of the wings being furcate posterior to the middle, and by the anterior margin of the pronotum being obtusangulately produced a little.

Vertex transverse, slightly concave, longitudinomedianly carinate, subangulately rounded anteriorly. Ocelli a little nearer to the base than to the apex, about three times as far from the eyes as from one another. Frons and clypeus strongly carinate, the former narrow and little swollen, the carina strongly raised. Rostrum reaching to about posterior coxae. Posterior tibiae with one strong spine. Pronotum longitudinally carinate, about twice as long as vertex, scarcely wider than head and eyes, elevated posteriorly, posterior margin somewhat deeply emarginate. Tegmina subcoriaceous, 3 discoidals, costally with many veins, apical vein forked and reforked.

1. *leiala*, sp. nov.

Cinereous; with pale yellow pubescence; vertex and pronotum anteriorly with whitish markings, ocelli pale reddish. Tegmina mottled more or less with whitish, rather faintly. Head, pronotum, tegmina, etc., punctured.

Length: 6½-6¾ mill.

Hab: Queensland, Kuranda (viii P).

Bathyllus Stal.

Bathyllus Stal. 1866 Hem. Afric., 68.

1. *albigutta* (Walker).

Lepyronia albigutta Walker 1858, List. Hom. Suppl., 191.

L. moerens Stal. 1854 O. V. A. F., XI, 251.

I somewhat doubtfully refer two individuals in my own collection, to this genus and species, but Stal, says that the anterior angle is acute, in these it is distinctly rounded.

The following Cercopinae have been recorded from Australia but are unknown to me:

Gen. *Hindola* Kirkaldy, 1900, Entom. XXXIII, p. 243.

1. *Aphrophora compacta* Walker, 1851, List. Hom., 701 (=*A. semiflava* Walker, 1858, Suppl. 187.)
2. *Lepyronia* (?) *australiae* Walker 1851 List. 727 (=*Aphrophora admittens* Walker 1858, Suppl. 345=*A.* (?) *areolata* Walker l. c.)
3. *Carystus reticulatus* Spangberg 1878, O. V. A. F., XXXIV No. 9, p. 12.
4. *C. stali* Spangb., l. c.
5. *C. sorurculus* Spangb., l. c.
6. *C. mutabilis* Sprangb., op. c., 13.

Gen. *Uncertain?*

1. *Aphrophora albicincta* Erichson, 1842, Archiv. Ent., I, 285.
2. *A. bifrons* Walker 1851 List. 702.
3. *Lepyronia convexa* Walker 1851 op. c., 726.

Subfam. 3. Machaerotinae.

The following form, unknown to me, has been described from Australia.

Gen. *Macherota* Burmeister 1835, Handb. Ent. II, 127 and 128.

1. *M. pugionata* Stal. 1865, O. V. A. F., XXII, 154.

Fam. Fulgoridae.

Subfamily Fulgorinae.

Distinguished by the reticulation of the anal area of the wings; the clypeus is carinate laterally. A large number of the forms are brightly colored, while the same or others are remarkable for the extraordinary shape of the head. In the Australian genera at least, the radial, median and brachial veins issue separately from the apical margin of the basal cell. These forms are apparently poorly represented in Australia, only 3 genera and 11 species being known; of these 1 genus and 3 species are now added.

1. Head produced in front, longer than the nota..........2.
1a. Head very little prominent before eyes, shorter than the nota together.......................3 *Desudaba* Walker.
2. Costal margin arched; vertex wider than eye, prolongation strongly narrowed anteriorly...........1 *Eurystheus* Stal.
2a. Costal margins subparallel in repose; vertex not wider than an eye, prolongation not narrowed anteriorly..........
..........................2 *Eurinopysche*, gen. nov.

Eurystheus Stal.

Eurystheus Stal, 1862 Berlin. Ent. Zeit VI, 303.

Although described in 1862, this genus was not included by Stal in 1866 in his table of genera in the "*Hemiptera Africana*."

1. *dilatata* (Westwood).

Fulgora dilatata Westwood 1842 Trans. Linn. Soc. London XVIII, 146, Pl. XII, figs. 8 and 9.

Length: 15½ mill.

Hab: Western Australia, Swan River.

This species and *Eurinopysche obscurata* were included by Walker in his new genus *Prolepta*, but are not congeneric with his type *P. apicalis* from the Philippines.

2. *perkinsi* sp. nov.

Close to *E. dilatata,* but cannot be that species, as it is much larger, the vertex longer and not tapering during the apical two-thirds, about as long as the thorax and abdomen together. The specks on the tegmina are smaller and not ocelliform, are at least twice as numerous, the apical part of the tegmina being well sprinkled. The coloring is that of *E. dilatata,* but the tegminal markings are, as a whole, paler. In profile the serrations of the head are flatter and shallower.

Length: 27 mill.

Hab: Queensland, Bundaberg (xi), bred; arboreal.

Eurinopsyche, gen. nov.

The type of this was one of the original species of *Eurystheus,* but can scarcely be included therein. It differs more particularly by the different form of the head, the vertex at base being narrower than an eye. Tegmina decumbent (in *Eurystheus* they are subtectiform), costa scarcely arched. Pronotum with sublateral subtransverse arched keels.

1. *obscurata* (Fabr.)

Fulgora obscurata Fabricius 1781 Spec. Ins. II, 315; Westwood 145, Pl. 12, f. 7.

Length: 20½-21 mill.

Hab: Queensland, Bundaberg (xi), Brisbane (vi), arboreal.

There is a nymph of an allied form, in which the cephalic prolongation is sensibly widened anteriorly. This nymph, like all those of this sub-family, is liberally endowed with sensory organs. The vertex has them literally everywhere it is possible to crowd them; on the ventral part of the prolongation there are none and only a few on the frons proper; none on the clypeus. They are sparser, but still numerous, all over the nota, tergites and even on the tegminal pads.

Length: 11 mill, width 4½ mill.

Hab: Brisbane (xi).

From Sydney (i), there are two specimens, in which the head is much longer than in any of the other forms and is spatulate anteriorly. The spatulate part is crowded with sensory organs, but there are comparatively few others on the head. Those on the nota and abdomen much as in the Brisbane forms.

Length: 8½ mill, width 2 mill. Pl. XXIX, fig. 11.

These nymphs appear to belong to undescribed species (and possibly genera).

Koebele's No. for this is the same as for *Thanatodictya hebe*, but this nymph scarcely belongs to a Dictyophorine, it probably only means that the same parasite attacks both.

Desudaba Walker.

Desudaba Walker 1858 Suppl., p. 58.

Metanira Stal. 1863 Stettiner Ent. Zeit. XXIV, p. 236.

There are 6 species of this genus, Australian and Papuan, which may be separated as follows:

1. Wings basally with a reddish or yellow spot............2.
1a. Wings basally with a bluish or greenish spot............5.
2. Head, pronotum and scutellum blackish...............3.
2a. Head, etc., more or less olivaceous..3 *danae* (Gerstaecker).
3. Frontal process reaching to base of vertex....6 *circe* (Stal.)
3a. Frontal process reaching to about middle of vertex......4.
4. No red spots on tegmina.............1 *psittacus* (Walker).
4a. Red spots on tegmina.................2 *maculata* Distant.
5. Abdomen black, marked with green basally; ground color of tegmina basally red-brown, spotted with yellow (Papua) ....4 *scylla* Distant.
5a. Abdomen black, with 3 greenish fasciae (sometimes broken into 4 spots), sternites apically greenish; basal ground color of tegmina dark crimson, no yellow spots.....5 *aulica* Stal.

1. *psittacus* Walker.

D. psittacus Walker, 1858, Suppl., 59.

Metanira thisbe Stal. 1863, Stettiner Ent. Zeit. XXIV, 236.

Length: 16 mill.

Hab: Queensland, Brisbane (my coll); recorded from Moreton Bay (Walker and Stal.)

2. *maculata* Distant.

D. maculata Distant 1892 T. E. S. London, 277.

Hab: Queensland, Peak Downs.

3. *danae* (Gerst).

Metanira danae Gerstaecker 1895 Mt. Nat. Ver. Neu-Vorpommern XXVII, 24.

Hab: Queensland (Gerst); Bundaberg (11 P), on wild and cultivated *Citrus*.

5. *aulica* Stal.

D. aulica Stal. 1869 Berlin. Ent. Zeit. XIII, 241.

Hab: Queensland; Cairns; also Rockhampton (Stal), arboreal.

6. *circe* (Stal.)

Metanira circe Stal. 1863 Stettiner Ent. Zeit. XXIV, 237.

Hab: Lizard Island.

N. B.—There are two Lizard Islands, one off Queensland, the other near Lefu. This might well be either.

Subfamily Dictyophorinae.

Antennae very much as in Fulgorinae. Rostrum with last segment sufficiently long. Radial and cubital veins with a common, short stem; anal vein running into commissure; no transverse veins in the costal cell. Anal area of wings not reticulate.

1. Clavus with a transverse vein . . . . 1 *Cajeta* Stal.
1a. Clavus without transverse vein . . . . 2.
2. Tegmen with a veined costal cell; posterior margin of pronotum truncate . . . . 4 *Astorga*, gen. nov.
2a. Tegmen without costal cell; posterior margin of pronotum angularly marginate. . . . . 2.
3. Color testaceous marked with blackish brown. Lateral margins of pronotum distinctly rounded . . . . 2 *Thanatodictya* gen. nov.
3a. Color greenish; lateral margins of pronotum straight or slightly concave . . . . 3 *Hasta* gen. nov.

Cajeta Stal.

Cajeta Stal 1886 Hem. Afr. IV, 150.

1. *singularis* Stal.

C. singularis Stal. 1866 Berlin Ent. Zeit., X, 391.

Hab: "North Australia." (Probably Queensland).

Thanatodictya, gen. nov.

Allied to *Dictyophora* Germar. Head very elongate, narrow; lateral margins of vertex subparallel, slightly broadened and obtuse-angulate at the apex; as seen in profile the head is straight and correct, eyes touching pronotum. Vertex bordered on each side by a keel, and there is a median keel which is usually subobsolete except about the basal fifth and the extreme apex. Frons 5-carinate, including the lateral margins. Clypeus tricarinate. Second antennal segment small, globular. Tegmina hyaline, apical third subreticulate. Legs simple, posterior tibiae 4-spined.

1. Tegmina with a broad, entire, longitudinal, dark stripe; vertex basally only slightly nodulose (subgen. *Lucinda* nov.... ....2 *lucindae* sp. nov.
1a. Tegmina colorless, except the dark apical third, or less...2.
2. Vertex not nodulose basally; head porrect; Stigma pallid, composed of 5 or 6 cells; length over 14 mill............. ....1 *praeferrata* (Distant).
2a. Vertex strongly nodulose at base (stigma darker) (subgenus *Niculda* nov., type *anadyomene*)...................3.
3. Stigma with 3 or 4 inconspicuous transverse veins; head somewhat ascending; length under 10 mill............... ....3 *anadyomene*, sp. nov.
3a. Stigma composed of 2 cells; head porrect...............4.
4. Darker; length 11 mill....................4 *hebe* sp. nov.
4a. Paler; length 9 mill.....................5 *psyche* sp. nov.

Subgenus *Thanatodictya* nov.

1. *praeferrata* (Distant).

Dictyophora praeferrata Distant 1892 Trans. Ent. Soc. London, 279.

Length: 12-15 mill.

Hab: Queensland, Bundaberg (ix-xii), reported from Peak Downs by Distant.

Subgenus *Lucinda* nov.

2. *lucindae* sp. nov.

Testaceous, keels of head in front of eyes black; lateral margins of pronotum and scutellum (exterior to keels) and abdomen mostly, blackish brown. Tegmina hyaline, veins pallid, a longitudinal blackish brown entire stripe broadening apically. Legs brownish testaceous, narrowly striped with blackish brown.

Length: 10-12 mill.

Hab: Queensland, Lucinda Point (vii) on rushes.

Subgenus *Niculda* nov.

3. *anadyomene* sp. nov.

Blackish or blackish brown; head testaceous or stramineous, except the apex, keels in front of the eyes and frontal area between submedian keels; base of vertex and disk of pronotum pale brownish testaceous, a longitudinal ivory white stripe on emesonotum extending to posterior angle. Under side pale, sordid, testaceous, marked with black. Tegmina and wings hyaline, colorless, veins pale brownish, apically many of them whitish; 2 black smudges, one from apex of suture to apex of tegmen broadly, the other on the stigma, etc. Head slightly ascending, about as long as the nota and abdomen together.

Length: 6½ mill to apex of abdomen; 7½-9½ mill to apex of tegmina.

Hab: Bundaberg (ix-xii), Brisbane (xi), arboreal.

4. *hebe*, sp. nov. (Pl. XXIX, fig. 10).

More or less sordid ferrugineous. Keels on head black in front of eyes. Pronotum with a longitudinal ivory white line broadening out on the scutellum, the posterior angle being entirely ivory white. Lateral margins of the ventral part of the pronotum, lateral margins of mesopleura, etc., ivory white. Lateral margins of the ventral part of the pronotum, lateral margins of mesopleura, etc., ivory white. Tegmina colorless, hyaline; veins, stigma and a smudge from apex of claval suture obliquely to apex of tegmen, blackish or brownish black. Abdomen marked with black.

Length: 11 mill.

Hab: New South Wales, Sydney (ii).

5. *psyche* sp. nov.

Allied to the preceding but smaller and paler. Head nearly as long as the rest of the body. Pale greenish grey, disk of vertex (on either side of the central keel) and vertex apically, blackish brown. Scutellum pale brownish testaceous with a central ivory white line, which does not quite reach the ivory white posterior angle. Tegmina hyaline, colorless, veins and stigma pale brown, an apical smudge similar to that in the preceding species, but paler. Some of the short transverse veins in the apical part of the tegmen narrowly ivory white.

Length: 8½-9 mill.

Hab: New South Wales, Mittagong (i).

The following species are unknown to me:

6. *Dictyophora bifasciata* Distant 1892 Tr. E. S. London, 279 from Peak Downs, apparently closely allied to *T. lucindae*, but the sternites are ochraceous.

7. *D. insignis* Distant l. c. from same locality. Probably allied to *T. anadyomene* but the coloration appears to be different.

Hasta, gen. nov.

Allied to *Thanatodictya*, but head and pronotum differently formed. In the latter the lateral margins of pronotum are convex, in the present genus they are straight or a little concave. Head slightly ascending, somewhat tapering. Central keels of vertex and frons entire. Eyes small, elongate. Lateral margins of scutellum more rounded basally. Tegmina with apical cells and with many transverse veins; costal cell without transverse veins; stigma composed of three cells. Posterior tibiae 3-spinose.

There are two species:

1. Head about as long as nota and abdomen together; veins green; length 18-19 mill. . . . . *hastata* sp. nov.
2. Head about as long as pronotum and mesonotum together; veins of wings blackish brown; length 11½ mill. . . . . *paupera* sp. nov.

1. *hastata* sp. nov.

Immaculate grass-green, keels of scutellum tinged with blue. Tegmina and wings hyaline, colorless, veins green. Brachial vein forked nearer to the base than the cubital, which is forked nearer to the base than the radial. Subcosta apically very narrowly brownish.

Length: 18-19 mill.

Hab: Queensland, Cairns (viii) on grass.

2. *paupera* sp. nov.

Immaculate green, of a yellower hue than the preceding. Veins of wings blackish brown.

Differs from *H. hastata* by the vertex being only about as long as the pronotum and mesonotum. Eyes more prominent. The radial is forked nearer the base than is the cubital, this nearer the base than the brachial.

Length: 11½ mill.

Hab: Queensland, Cairns (viii) on grass.

Astorga, gen. nov.

Not closely related to any other Dictyophorine; has a little the appearance of a long nosed *Elasmoscelis*, but the anal vein runs into the commissure.

Vertex narrow, about twice as long as broad, extending well in front of prominent eyes which do not extend laterally so far as the pronotum; carinate medianly the keel extending to posterior margin of scutellum. Frons ventrally curved as seen in profile; long and narrow and depressed along the middle, many times longer than wide; not carinate medianly; dorsally it caps the vertex and is about half the length of the latter, truncate, not carinate. Ocelli very small. Antennae small, second segment cylindric, about twice as long as wide. Pronotum medianly about two-thirds the length of the vertex, tricarinate, posterior margin truncate. Scutellum about two and one-half times as long as pronotum, tricarinate. Tegmina flat, or slightly tectiform, costa roundly arched, narrowing apically, apical margin obliquely sub-truncate. Costal cell wider at maximum than the subcostal cell, the former with transverse veins; radial forked at about one-fourth of length of tegmina, median a little before middle, cubital about the middle, no subapical line. Anterior femora dilated.

I have placed this among the Dictyophorinae because of the general fundamental structure, and that of the antennae. The venation is typically Dictyophorine, but there is a costal cell with transverse veins.

1. *saccharicida*, sp. nov. (Pl. XXVIII, figs. 10-13.)

Brownish testaceous; head paler, abdomen mostly darker: frons laterally and dorsally marked with short brownish lines.

Tegmina pale brownish yellow, a brownish smudge on costal membrane and costal cell, also on apical margin (except extreme apex) with subparallel darker stripes, and two longer ones near apex across tegmen, also one or two small irregular specks on disk of corium and clavus. Wings pale smoky, veins pale brown. Legs lined with brownish.

Length : $7\frac{1}{2}$-$8\frac{3}{4}$ mill.

Hab : Queensland, Cairns (vii-viii) on sugar cane and grasses

Subfamily 3. Cixiinae.

Apical part of tegmen not reticulate, much fewer cells than in Dictyophorinae. Radial and median veins approximate at base, remote from cubital. No subcostal cell. (Usually three ocelli.) Anal vein running into commissure.

It is difficult to differentiate this subfamily from the Dictyophorinae by words, but they can hardly be confused. As a rule the latter are much more elongate and the apical parts of the tegmen reticulate or with many apical cells.

1. Antennae minute....................................2
1a. Antennae elongate, distinctly visible beyond the lateral margins of the head.............1. *Solonaima* gen. nov.
2. Scutellum with 5 keels, 3 ocelli present....2 *Oliarus* Stal.
2a. Scutellum with 3 keels, 2 ocelli only..................3
3. Head produced well in front of eyes, vertex elongate....4
3a. Head little or not produced in front of eyes, vertex transverse.....................5. *Calamister* gen. nov
4. Tegmina of the usual *Cixius* form..3. *Carolus* gen. nov.
4a. Tegmina in repose (as seen dorsally) very strongly narrowed apically..............4. *Gelastocephalus* gen. nov.
(*Lamenia* Stal is not included in this table.)

1. *Solonaima*, gen. nov.

Apparently allied to *Brixia* Stal, but the antennae are longer and more cylindric; frons lightly carinate, etc.

Head and eyes much narrower than pronotum; lateral margins of the deeply concave vertex convergent postero-anteriorly, anterior margin truncate, posterior margin deeply emarginate. Frons with an apical ocellus; roundly curved as seen in profile, the disk deeply concave, very narrowly almost to apical margin (ventral) eyes, then widening a little, medianly slightly carinate.

Part of the frons is visible dorsally owing to short vertex. Clypeus elongate, carinate laterally. Eyes deeply excavated beneath. First segment of antennae cylindric, reaching nearly or quite to lateral margin of frons; second longer than first, cylindric, reaching well beyond base of clypeus. Posterior legs elongate, tibiate spineless.

1. *solonaima*, sp. nov.

More or less pale fulvotestaceous; eyes and first segment of antennae black, as also tergites more or less. Sternites more or less sordid. Tegminal veins pale and darker brown, not granulate nor piliferous.

Length: (male), 6-6¼ mill.

Hab: Queensland, Cairns (viii.)

Oliarus Stal.

Oliarus Stal. 1862 Berlin Ent. Zeit. VI, 306; Kirkaldy 1902 Faun. Haw. III, 119.

An almost cosmopolitan genus, very rich in species. None have up to the present been described from Australia, but 9 are now brought forward here.

In all the Australian forms known, the cubital is forked nearer the base than is the radial.

1. Axillary vein of clavus running into anal vein, basal of the middle of the latter..............................2.
1a. Axillary running into anal at, or apical of, the middle of the latter......................................5.
2. Axillary very short, not quite half (taken always from its curving or angulation at the commissure) the length of the stalk of the anal...............1. *laertes* sp, nov.
2a. Axillary long, more than half the length of the stalk of the anal...3.
3. Tegminal veins more or less thickly granulate........4.
3a. Tegminal veins not (or obsolescently granulate)...... ....2. *kampaspe*, sp. nov.
4. Head and scutellum pale, veins pallied, granulate with brownish-black.....................3. *talunia*, sp. nov.
4a. Head and scutellum black and castaneous, veins dark.. ....4. *asaica*, sp. nov.
5. Vertex short and broad, the forking taking place near the apex.............................5. *felis*, sp. nov.

5a. Vertex longer, forking about the middle..............6.
6. Species less than 5 mill. long; vertex long and narrow, much narrower at base than at eye..6. *alexanor,* sp. nov.
6a. Species more than 6 mill. long; vertex wider, scarcely or not narrower at base than an eye....................7.
7. 8½ mill long; veins not granulate.......9. *lubra,* sp. nov.
7a. 6½ mill long....................................8.
8. Tegminal veins granulate............7. *sponsa,* sp. nov.
8a. Tegminal veins not granulate........8. *phelia,* sp. nov.

1. *laertes,* sp. nov.

Blackish, keels more or less ferruginous. Pronotum otherwise entirely black. Veins brownish, base of apical cells narrowly infuscate, stigma dark. Tibiae and tarsi more or less ferruginous.

Vertex elongate, twice as long as broad, much narrower than an eye. Rostrum reaching to posterior coxae. Tegmina granulated, very lightly piliferous. Auxillary vein running into anal, scarcely apical of the posterior angle of the scutellum; that is at about one-fourth of its length, consequently the axillary is much shorter than the basal part of the anal and is in the same straight line as the apical part of the anal, the basal part of the anal being much curved. Posterior tibiae with a median spine and one near the base, also two tiny basal spines.

Length: 5½ mill.

Hab: New South Wales, Mittagong (i).

2. *kampaspe,* sp. nov.

Close to *O. alexanor* but larger and not granulated, claval venation different. Tegminal veins dark and pale brownish, bases of apical cells infuscate.

Length: 5⅓ mill.

Hab: Queensland, Kuranda (viii).

3. *talunia,* sp. nov.

Pale testaceous, lateral margins of scutellum and the space between sublateral and median keels, browner. Apices of apical veins and the bases of apical cells rather widely infuscate. Vertex long and narrow, acutangularly apically. Veins strongly granulate, scantily piliferous.

Length: 5 mill.

Hab: Queensland, Cairns (viii).

4. *asaica*, sp. nov.

Head, scutellum within lateral keels and some marks on pronotum, blackish ferruginous; keels on head, etc., ochraceous. Apical half of frons ferruginous, also keels on scutellum. Scutellum outside lateral keels, apical segment of rostrum, sternites etc., ferruginous; femora sordid ferruginous, tibiae paler. Tegmina hyaline, veins dark brown and pale brown; stigma brown; bases of apical cells thickened, darked. Similar in proportions to *O. lubra*, but much smaller; the lateral margins of the vertex fork nearer to the apical margin than to the middle and there is a tiny transverse keel uniting the two oblique keels just posterior to the apical margins; the frontal fork is very close to the posterior margin of the frons. Vertex much narrower than in *O. lubra*, and the lateral margins posteriorly less divergent. Rostrum reaching beyond middle of posterior coxae. Posterior femora with a strong median spine and two small ones nearer base (basal one obsolescent). Tegmina more granulate, slightly piliferous.

Length: 7 mill.

Hab: New South Wales, Sydney (i).

5. *felis*, sp. nov.

Blackish, keels of head and pronotum more or less pallid. Keels of scutellum obscurely blackish ferruginous. Vertex broad. Vertex at base a little wider than median length, wider than an eye. Tegmina lightly granulate and lightly piilferous. Axillary vein joining anal about midway between posterior angle of scutellum and apex of clavus, shorter than basal part of anal. Tibiae with a basal and a median spine.

Length: 4 mill.

Hab: Queensland, Cairns (viii).

6. *alexanor*, sp. nov.

Blackish, keels more or less yellow on head and pronotum, more or less ferruginous on scutellum. Basal two-thirds of tegminal veins pale, darkly granulated, apical third darker, bases of apical cells infuscate. Legs pallid.

Tegmina minutely but closely granulated, not piliferous. Posterior tibiae with one spine a little basal of the middle, and an obsolescent basal one.

Length: 5 mill.

Hab: Queensland, Cairns (viii).

7. *sponsa*, sp. nov.

Ferrugineotestaceous, more or less pale. Veins of tegmina and stigma sordid stramineous; stigma internally, apical veins etc., brownish, the bases of apical cells a little thickened. Head, granulations, etc., as in *O. lubra*, except that the forking is a trifle nearer to the middle. Costa arched slightly, very obtuse angularly close to base.

Length: (male), 6¾ mill.

Hab: Queensland, Cairns (viii).

8. *phelia*, sp. nov.

Pale yellowish ferruginous, pronotum pallid, scutellum more or less blackish, tegmina as in *O. asaica*, except that the apical veins are more infuscate apically. Tergites more or less marked with blackish. Head as in *O. asaica*, except that the vertical forking occurs about the middle. Rostrum reaching to about intermediate coxae. Tegmina not (or scarcely) granulate, not piliferous. Posterior tibiae with two small spines on basal half (basal one obsolescent.)

Length: 6¼-6½ mill.

Hab: Queensland, Kuranda (viii), Nelson (vii).

Var: Blackish ferruginous; keels of vertex and frons pale ferruginous. Pronotum pallid, two streaks on scutellum ferruginous.

9. *lubra*, sp. nov.

Head and legs ochraceous; the apex of the vertex, the three cells between vertex and frons, clypeus, sterna (mostly), the scutellum between the median and submedian keels and outside the lateral keels etc., blackish. Pronotum yellowish, more or less fuscate. Scutellum between submedian and lateral keels, and the keels themselves, ferruginous. Sternites mostly yellowish. Tegmina hyaline, veins and stigma yellowish-brown and brown; stigma internally brownish. The bases of the apical cells a little infuscate. Veins of tegmina feebly and very minutely granulate; not piliferous.

Vertex about as wide as an eye, appears longer than wide, though the basal width is actually greater than the median length, with the base deeply acutangularly emarginate, medianly carinate slightly, and a sublateral carina on each side starting from lateral margin at about one-third of its length and proceeding towards middle of anterior but turning off just before it reaches there, meeting the anterior margin at right angles. Frons forked about middle of anterior lobes. Rostrum reaching to about midway between intermediate and posterior coxae. Submedian keels of scutellum very slightly rounded externally. Costa straight, not or scarcely arched. Axillary vein running into anal at about its middle, and shorter than the basal part of the anal. Posterior femora with two small spines on basal half.

Length: (male), 8½; female), 8½-9¼ mill; width, 2⅓ mill.

Hab: Queensland, Bundaberg (ix-xii), Brisbane (xi).

Carolus, gen. nov.

Like *Cixius* in appearance, with longer head.

Vertex triangular, extending well in front of eyes, a little rounded at tip, longer than wide, disk much hollowed out, carinate medianly, lateral margins acute, subvertical. Frons and clypeus sublanceolate, the former subnodulose near the base, carinate medianly; clypeus carinate medianly and laterally; no frontal ocellus. Pronotum truncate apically in the middle, posteriorly deeply rectangularly emarginate. Scutellum strongly tricarinate. Radial and cubital veins forked about the same place, i. e., a little nearer the base than the middle of the tegmen. Tibiae not spinose.

1. *crispus*, sp. nov.

Head, pronotum and underside more or less pale sordid ferruginous (sterna and sternites partly darker.) Scutellum ferruginous, laterally darker. Tegmina hyaline, veins yellowish-testaceous, thickly granulated with blackish, strongly but shortly piliferous.

Length: (male), 6¾ mill.

Hab: New South Wales, Sydney (i.)

Gelastocephalus, gen. nov.

Allied to *Carolus*, but the tegmina in repose as seen dorsally, are almost linear posteriorly.

Head and eyes narrower than pronotum. Vertex elongate, somewhat ascendant, the disk depressed, the lateral keels acute, converging anteriorly straightly, strongly prominent in front, nearly twice as long as wide, anterior angle acute, slightly rounded; posterior margin roundly emarginate. Eyes longer than broad, extending laterally as far as anterior margin of pronotum.

Frons and clypeus medianly fused, spindle-haped, the former strongly carinate laterally, the keels suddenly curving around to the thorax a little apical of the middle of the fused segments. Ocelli small but distinct, the frontal one absent. Clypeus angulate; not carinate laterally. Antennae small, not inserted near clypeus.

Pronotum almost linear, anterior margin very highly angularly arched, lateral margins short, diverging; posterior margin deeply, acutangularly emarginate. Scutellum diamond-shaped tricarinate.

In repose the tegmina (as seen dorsally) are arched laterally posterior to the shoulders, apical half very strongly narrowed. Legs short, anterior femora slightly longer than tibiae, posterior tibiae spineless, first segment of tarsi longer than 2nd and 3rd together.

1. *ornithoides*, sp. nov. (Pl. XXXII, figs. 6-7).

Head and pronotum pale ferruginous; scutellum, apex of clypeus, sterna (mostly), abdomen etc., black. Clavus pale fulvous, rest of tegmina cinerous; apical third, a blotch about the middle and most of the costal margin between these dark brownish. Corium strongly and closely granulate with dark brown, not (or very shortly and scantily) pilose. Femora and tibiae dark brown, tarsi pallid.

Length: male, 5 mill.

Hab: New South Wales, Sydney (i).

Calamister, gen. nov.

Vertex transverse, disk depressed, not carinate medianly, apically rounded, very slightly produced before the eyes. Frons widening out apically, medianly carinate, no frontal ocellus. Clypeus rather obsoletely carinate laterally. Scutellum tricarinate. Venation as in *Carolus*. Tibiae not spinose.

1. *obscurus*, sp. nov.

Testaceous, vertex a little darker. Tegminal veins pale brownish, lightly granulate, slightly piliferous.

Length: 5 mill.

Hab: Queensland, Bundaberg (ix-xii.)

Lamenia, Stal.

Lamenia Stal 1859 Eugenies Resa Zool. 277 Pl. IV, fig. 5; Ashmead 1889 Ent. Amer., V, 4; Melichar 1905 Wein. Ent. Zeit. XXIV, 285.

Herpis Stal 1860 K. Svensk. Vet. Akad. Handl., XIII, No. 6, p. 8.

Stal placed this among his Derbida, while Ashmead locates it in his subfamily Flatinae between *Siphanta* and *Amphiscepa*. It appears to me to be a *Cixiine*; it cannot be placed among the Derbidae because the anal vein of the tegmina runs into the commissure and it cannot be a "Flatid," first on account of the venation, and secondly because there is no trace of intervenal (or any) granulation. It might be located in the Achilidae were it not for the course of the anal vein.

It has a very wide distribution; i. e., well over the American continents, Polynesia, Africa, etc.

1. *kulia*, sp. nov. (Pl. XXI, fig. 4.)

Differs from *L. vulgaris* (Fitch),* by the frons being much more declivous and the lateral margins distinctly, sinuately, widened apically (in *fitchi* they are nearly parallel.) It differs from *L. caliginea, orba, pallidovenosa, fimbricola*, etc., by the colour and from *lugubrina* by the form of the frons.

Vertex and pronotum sordid brownish, frons and clypeus sordid ferruginous. Scutellum polished black. Tegmina subhyaline, dark smoky, with a blue tinge. Legs pale. Abdomen more or less blackish.

Vertex very short, transverse, anteriorly roundly truncate; frons with lateral margins sinuate, apically widened.

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* The only species I have seen, kindly lent me for examination by my colleague, Mr. Swezey.

Length 3 mill to apex of abdomen, 4¾-5 mill to apex of tegmina.

Hab: Queensland, Cairns (vii-viii), Nelson (vii) on grass.

2. *hiva*, sp, nov.

Allied to the preceding but the vertex is wider, as wide as or wider than an eye; the frons wider and shorter, angulate laterally just posterior to apical margin, strongly carinate medianly. Pronotum lutescent.

Length: 5½ mill.

Hab: Queensland, Bundaberg, (ix-xii type), Cairns (viii), Kuranda (viii) on grass.

The following supposed Cixiines are unknown to me, viz:

1. *Cixius laevifrons* Walker 1858 Ins. Saund., 43.
2. *Prosops pedisequus* Buckton 1893 Vict. Nat. X, 49.

Fam. Asiracidae.

Perkinsiella, Kirkaldy.

Perkinsiella, Kirkaldy, 1903, Entomologist XXXVI, 179.

Head short, scarcely extending beyond apical margin of eyes; vertex about as wide as an eye, transverse, 7-sided, divided by median keel into two 5-sided areas, somewhat deeply and roundly impressed; posterior margin truncate. Eyes reniform, oblique, latero-posteriorly extending to about half the length of the pronotum. The two apices of the vertex each give forth a keel, these unite near the top of the head at about three-fourths of the length of eyes (as seen from below), thence continuing to the apical margin of the flattish frons which is slightly emarginate; lateral keels of the frons straight (except at their base where they curve around meeting the 2 small basal forks of the median keel), subparallel (very slightly convergent towards the apex) and contiguous to the inner margin of the eyes. Lateral keels of genae meeting lateral keels of frons at an acute angle at the apical margin. All these keels are narrow, but well marked. Frons about the same width or a little narrower than an eye. Clypeus 3-carinate.

Antennae with 1st segment flattened, apically dilated, triangular; 2nd segment longer than first, flattened more or less, a trifle narrower at apex than at base. Pronotum transverse, widely emarginate obtuse-angularly at base, 3-carinate, lateral keels arising at the apical margin close to the eyes, diverging slightly almost to posterior margin, and ending just before it, a trifle anterior to this, they are carried on laterally under the eyes by a series of small, raised pustules. Scutellum longer than the pronotum, 3-carinate, the middle keel entire, lateral margins of posterior prolongation straight. Anterior and intermediate legs simple, not dilated. Posterior tibiae longer than tarsi with 2 lateral and 4 apical spines; first tarsal segment longer than the others together. Tibial spur three-fourths of the length of the tibia, with about 40 spinelets. Species dimorphic or monomorphic.

1. Frons more or less uniformly pale brownish, with transverse whitish dots both basally and apically. (Male with subcostal, median and apical cells, dark smoky. Female narrowly suffused by smoky on each side of 2nd-5th apical veins.)..........................4 *vastatrix* (Breddin).

1a. Frons basally dark brown, apically whitish, the former only with transverse whitish dots.........................2.

2. Males (all longwinged)*..............................3.

2a. Females.......................................5.

3. Scutellum laterally broadly dark brown...................................1 *saccharicida* Kirkaldy.

3a. Scutellum concolorous.............................4.

4. Antennae shorter, granulations stronger and dark.....................................2 *graminicida* sp. nov.

4a. Anterior longer, granulations feebler and paler...3 *vitiensis* sp. nov.

5. Longwinged forms.................................7.

6. Tegmina almost immaculate, some of the apical veins lightly suffusedly infuscate.............3 *vitiensis* sp. nov.

6a. Median cell sometimes smoky, also 5th and 6th apical cells (except small hyaline spots at apex).......................................1 *saccharicida* Kirkaldy.

7. Antennae longer and stouter, tegminal granules comparatively feeble and paler.........1 *saccharicida* Kirkaldy.

7a. Antennae shorter and less stout, tegminal granules darker..........................2 *graminicida* sp. nov.

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* Since this was in proof, Mr. Muir has written from Viti that P. *vitiensis* is dimorphic in both sexes.

1. *saccharida* Kirkaldy. (Pl. XXVI; Pl. XXVII, figs. 1-5).

Perkinsiella saccharicida Kirkaldy 1903 Entom. XXXVI, 179; Perkins 1903 Bull. I, Comm. Agr. Hawaii; Van Dine 1904 Bull. Hawaii U. S. Agr. Exp. Sta. 5.

Testaceous, lateral margins of pronotum and scutellum dark brown, basal half of frons and most of the clypeus light brown, the former with 2 or 3 short narrow interrupted transverse pale lines near the base. A large black spot on anterior coxae, intermediate coxae and mesopleura each; abdomen black variegated with testaceous. Apex of first segment of antennae black, second segment brownish. Tegmina hyaline, commissure whitish. Anterior and intermediate tibiae annulate with blackish.

Male always macropterous; the 5th and 6th (and sometimes the 4th) apical cells dark smoky, the stripe being sometimes continued very narrowly to the base of the tegmen. Genital segments mostly black.

Female dimorphic (with intermediate forms); longwinged form with the tegminal stripe usually broader on the corium; short winged form much stouter, with hyaline tegmina, a short narrow black line close to apex of clavus. Genital segments pale.

Length: 5-5⅞ mill (macropterous); 4 mill (brachypterous).

Hab: Wherever sugar cane is grown in Queensland, New South Wales, and Hawaiian Islands. (Koebele No. 2230). (See also the Introduction). Also on grasses and sedges.

2. *graminicida* sp. nov.

Closely allied to the preceding, but a little smaller. The tegminal veins are more thickly granulate especially in the female. Antennae a little shorter and less stout. Pronotum and scutellum scarcely darkened laterally.

Male always macropterous; exterior half of 5th and 6th apical cells smoky, also apices of apical veins, etc.

Female always brachypterous.

Length: (Male) 5 mill; (female) 4 mill.

Hab: Queensland, Cairns (vii-viii, Koebele's No. 2249), on grasses.

3. *vitiensis*, sp. nov.

Closely allied to the typical species, but pronotum and scutellum not darkened laterally.

Male macropterous; third to 6th apical cells smoky (except a small hyaline spot on each, near apex), also around 2nd and 3rd apical veins.

Female macropterous; tegmina immaculate except that the apical parts of 4th to 6th apical cells are more or less smoky.

Length: $4\frac{3}{4}$ (male), $5\frac{1}{8}$-8 mill (female).

Hab: Viti, Levuka, on sugar cane (III, Koebele's No. 2346).*

4. *vastatrix* (Breddin.)

Dicranotropis vastatrix Breddin 1896 Deutsch. Ent. Zeit. 107; Zehntner 1897 Arch. Java Suiker V., p. ? (Sep. p. 25); Krueger 1899 Das Zuckerrohr und seine Kultur p. 312, Pl. XIV, f. 1. c.; Busse 1904 Arb. Biol. Abt. Land. Kais. Ges. Amt., IV, 319-422. Plates I-II, etc.

Hab: Java, on Sugar Cane. (Breddin and my collection); also reported from German East Africa on *Andropogon sorghum* by Melichar (1905).

Peregrinus, Kirkaldy.

Peregrinus Kirkaldy 1904 Entom. XXXVII, 175.

Dicranotropis Van Duzee 1897 Bull. Buffalo Soc. N. H., V, 228 (nec Fieber).

1. *maidis* (Ashmead).

Delphax sp., Tyron 1889 Rep. Insect & fungus pests Queensland I, 193-6.

Delphax maidis Ashmead 1890 Psyche V, 323; textfigs.

Dicranotropis maidis Van Duzee 1897 Bull. Buffalo Soc. Nat. Sci., V, 240.

Peregrinus maidis Kirkaldy 1904 Entom., XXXVII, 176.

Testaceous, often tinged with orange, carinae paler; the apical three-fourths of the frons, the clypeus, first segment of the antennae and the second (except upper side of basal half), smoky brownish; lateral margins of scutellum dark brown. Femora dark brown.

Males dimorphic. Abdomen black; genital segments and laterally, paler. Longwinged form with tegmina hyaline, sometimes tinged with yellowish; costal, median and radial veins pale yellow, cubital and apical veins smoky, the latter suffusedly; fifth

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Mr. Muir has recently found brachypterous forms of both sexes.

to 7th apical cells apically smoky with a small hyaline spot on each, a black spot at apex of costal cell and a short black line at apex of clavus. Shortwinged form with hyaline tegmina, tinged with yellow, apex blackish brown, as also apex of clavus.

Females dimorphic, similar to the male.

Length: 4-5 mill. (macropt.), 3⅓ mill (brachypt.)

Hab: All through Queensland (Koebele's No. 2240) on *Zea mais, Cynodon dactylon* and *Bromus unioloides* (sec. Tryon); also in Hawaii on *Zea mais* and *Sorghum vulgare* (and occasionally on *Saccharum officinale*); Viti (iii), Florida and Texas.

The nymphs are pale orange yellow, immaculate except that there are small brownish rings around the spiracles.

Phacalastor, gen. nov.

Very close to *Peregrinus*, differing principally by the tegminal veins being very strongly granulate. Type *pseudomaidis*.

1. Apical veins of tegmina suffusedly infuscate............ ....*pseudomaidis*, sp. nov.
2. Apical part of tegmina with a dark semi-circular smudge, across tegmina and curving along the interoapical margin....................................*koebelei*, sp. nov.

1. *pseudomaidis*, sp. nov.

Very close to *Peregrinus maidis*, but the tegmina are strongly granulate with dark brown, and the nymphs are whitish, banded and spotted with dark brown.

Frons and antennae dark smoky brown, with a double (somewhat interrupted) line across the middle of the former. Femora smoky, apically black, tibiae pale annulated with black.

Males macropterous; genital segment black.

Females dimorphic; genital segment pale, a little infuscate. The shortwinged form has hyaline tegmina, with a large black spot apically.

Length: 3⅓-4 mill (macropt.); 2½ mill (brachypt.)

Hab: Queensland, Cairns (vii-viii) on grasses, casually on sugar cane (Koebele's No. 2236).

2. *koebelei*, sp. nov.

Allied to the typical species, but larger and stouter, posterior margin of pronotum less emarginate; tegminal granules much larger and darker. Pronotum and scutellum darker. Frons blackish brown with many pale yellowish specks, base of clypeus pale. Anterior coxae and a round spot on mesopleura dead black; anterior and intermediate legs brownish black, more or less annulate with pallid; posterior legs more or less pale. Tegmina hyaline with bright black granules, the transverse apical line suffusedly blackish brown, the color continuing curvedly from apex of clavus to exteroapical angle, forming a rough semi-circle; second and third apical veins suffusedly brownish black. Abdomen mostly black except anus, etc.

Male genital segments black.

Female genital segments black, ovipositor pale.

Length: 3¾-4⅛ mill (always longwinged).

Hab: Queensland, Cairns (vii-viii, Koebele's No. 2248), on grasses.

Stenocranus, Fieber.

Stenocranus Fieber 1866 Verh. Zoöl. bot. Ges. Wien XVI, 519, Pl. VIII, f. 3.

1. *agamopsyche*, sp. nov.

Differs from *S. saccharivora* (Westwood) by the much shorter, anteriorly rounded (dorsally) head, and by the color; from the other species, by the immaculate tegmina of which only the apices of the apical veins are dotted with dark brown; there is also a very short, narrow line at the apex of the clavus; the other species (except *saccharivora*) have a longitudinal smoky smear on the tegmina.

Testaceous; frons and clypeus, between the keels, black. Tegmina pale cinereo flavous, marked as above. Tergites testaceous with a sublateral suffused blackish stripe longitudinally on each side. The eyes are distinctly more rounded than in the species with striped tegmina, and are shorter in proportion to their width.

Length: 5-6 mill.

Hab: Queensland, Cairns (vii-viii, Koebele's No. 2242), on grasses and sedges.

2. *saccharivora*, (Westwood.)

Delphax saccharivora Westwood 1833 Mag. Nat. Hist., VI, 413 figs. 54a-c.

Stenocranus (?) *saccharivorus,* Van Duzee 1897 Bull. Buffalo Soc. V, 232.

Mr. Ballou of the West Indian Dep. of Agriculture has recently sent me specimens of this in all stages, enabling me to confirm Van Duzee's doubtful reference to *Stenocranus,* but too late to present a detailed study in this paper. The egg-slits are much more profusely covered with waxy substance than in *Perkinsiella,* approaching more, so my colleague Mr. Swezey informs me, to the condition of certain North American forms. The delicate pale green, immaculate adult cannot be mistaken for any other species; the head in profile is long and acute anteriorly. It is stated by Ballou (1905 West Indian Bull., VI, 41) to be of little importance as a pest in the Antilles, though formerly, some 70 years ago, it was, according to Westwood, Johnstone and others, exceedingly destructive in certain of the islands.

Hadeodelphax, gen. nov.

Allied to *Stenocranus* but differing by the form of the head, the venation, etc.

Dorsally the head is elongate, subquadrangular, extending well beyond the apical margin of the eyes; near the anterior margin of the eyes (but a little below) the lateral keels bifurcate at an acute angle, the inner keels meeting acuminately a little beyond the apex of the vertex; the latter is keeled medianly as far as the apical margin (dorsally) of the eyes, where it forks on each side at an obtuse angle meeting the inner forks of the lateral keels. Head much narrower than the pronotum. Eyes longer than broad, suboblique. Ventrally, the frons is somewhat narrow, widening a little apical of the eyes; lateral keels sinuate; these, with the median keel, strongly marked. No forking visible on frons. Antennae short. Clypeus tricarinate. Pronotum tricarinate, laterally straightly divergent, ending just before posterior margin. Scutellum tricarinate. Tegmina with about 9 apical areas, the base of the fourth not reaching as far basal as that of the third, the third not as far as the second, the second not as far as the first, the first not as far as the fifth. Posterior tibiae and tarsi about equally long.

1. *pluto,* sp. nov.

Blackish piceous; antennae and legs testaceous. Tegmina dark smoky, first and second apical cells and apex of costal cell, hyaline; commissure whitish, with a black spot near apex of clavus.

Length: $4\frac{1}{4}$ mill.

Hab: Queensland, Cairns (vii-viii, Koebele's No. 2247).

Gelastodelphax, gen. nov.

Somewhat allied to *Peregrinus* Kirkaldy. Head dorsally scarcely extending anteriorly beyond the eyes. Vertex transverse, lateral keels forking, the inner forking forming two acutangled apices; beyond that there is a smooth area, on which keels are obsolescent. The frons has a central keel; the lateral converging anteriorly, the lateral ones are subparallel, meeting keels of genae at an acute angle; antennae slender, second segment reaching well beyond base of clypeus, which continue on to the scutellum. Tegmina very short. Posterior tibiae much longer than tarsi, spur with nearly 50 teeth.

1. *histrionicus*, sp. nov.

Vertex smoky brown; clypeus yellowish testaceous; frons, antennae, sterna, legs and tegmina yellowish, the last named being broadly black basally, this continuing on to mesopleura. Pronotum, scutellum and basal half of abdomen whitish testaceous, a broad black band across the middle above; apical of this, pale red brown, becoming paler and more sordid apically. Sternites apically pale red brown. Genital segment mostly black. Tegmina reaching to a little beyond middle of body, apically truncate.

Length: (male), $2\frac{1}{2}$ mill.

Hab: Queensland, Bundaberg, on Sandhills (x).

Smicrotatodelphax, gen. nov.

Somewhat allied to *Delphacinus*, but the head and eyes are larger proportionately, the antennae and the frons different. The type is the smallest Fulgorid known to me.

Head, especially the eyes, very large, the latter extending laterally as far as the base of the tegmina, and posteriorly nearly touching the base of the pronotum. Vertex with lateral keels forking at about one-third of the length of the head (dorsally), meeting acutely on the top of the head ,continuing to apex of frons as a single keel. Antennae reaching beyond base of clypeus. Pronotum tricarinate, the lateral keels straight, diverging posteriorly, but practically reaching the posterior margin of pronotum. Scutellum transverse, with 3 somewhat obscure keels. Tegmina not nearly reaching apical margin of abdomen, rounded apically. Tibial spur with about 13 teeth.

1. *perkinsi*, sp. nov.

Testaceous, frons embrowned, eyes black. Tegmnia hyaline. Tergites hyaline. Tergites basally more or less pale orange brown, apex more or less black.

Length: (males), 1½ mill.

Hab: Queensland, Cairns.

Ectopiopterygodelphax, gen. nov.

Distinguished by the large, polished, convex pellet of chitin in the middle of the tegmina. The form of the head is different from that of any other Asiracid known to me.

Vertex long triangular, longer than pronotum, and longer than its own width at base; lateral margins carinate, meeting anteriorly in a slightly rounded acute angle, well beyond the apical margin of the eyes; median keel present but no other keels dorsally. Posterior margin of vertex slightly roundly emarginate. Eyes longer than wide, head and eyes wider than the length of the vertex. Frons suboval, lateral margins rounded; median keel strong and entire; lateral keels acute, starting from lateral keel of vertex at a lower (inverted) elevation than the middle keel, so that for at least the basal half of the length of the frons, the middle keel is strongly visible in profile; lateral keels apically remote from middle keel; apical margin of frons truncate. Genae narrow. Clypeus tricarinate. Antennae very short. Pronotum anteriorly rounded, posterior margin lightly emarginate, lateral keels remote anteriorly from middle keel (practically a continuation of the head keels.) Scutellum with 3 entire keels. Tibial spur short, with a large number of pale, translucent, ill-defined teeth.

1. *eximius*, sp. nov.

Pale green, faintly marked, mostly in interrupted longitudinal lines, with brown. Apex of frons, clypeus, genae (partly), sterna and abdomen, black. Tegmina subhyaline, pale brown; a large spot near the base a wide band across the middle of the corium (almost encircling the black pellet), and 3 large spots at apex of costal cell and on the basal apical-cells.

Length: 3½ mill.

Hab: Queensland, Cairns (vii).

Family Eutropistidae.

(=*Tropiduchida* Stal.)

I am a little uncertain as to the constituents of this; the antennal structure is often very obscure and I have not been able to examine it in some forms as I would wish. The subcostal cell is present and the costal cell usually provided with transverse veins; the anal vein runs into the apical angle of the clavus. The last segment of the rostrum is moderately long.

Monopsis Spinola, which Stal places in his Tropiduchida, appears to me to belong to the Dictyophorinae.

Australian and Vitian Genera.

1. Subcostal cell absent or exceedingly narrow .... 1. *Ossa* Motshulsky
1a. Subcostal cell present, costal cell with many transverse veins .... 2.
2. Head at least twice as long as wide . . 5 *Rhinodictya* gen. nov.
2a. Head little, if at all, longer than wide .... 3.
3. Frons with an oblique keel on each side between median and lateral keels .... 4. *Vanua* gen. nov.
3a. No oblique keels .... 4.
4. Vertex transverse; apical area of tegmen large .... 3. *Peltodictya* gen. nov.
4a. Vertex elongate, longer than wide; apical area very narrow .... 2. *Daradax* Walker.

Ossa Motshulsky.

Ossa Motsh., 1863 Bull. Soc. Nat. Moscou XXXVI, 2: 106; Melichar 1903 Hom. Ceylon 49.

Both the species hereinafter described, have the head more elongate than in the Sinhalese *O. dimidiata*.

1. Six red specks on vertex arranged longitudinally in 2 rows; length less than 7 mill. .... *venusta* sp. nov.

2. Six red specks on vertex arranged longitudinally in 3 rows, (middle row sometimes obsolescent); length over 7 mill. . . . . *formosa* sp. nov.

1. *venusta* sp. nov.

Pale greenish testaceous; vertex with six crimson specks, 3 on each side of the median keel, in a longitudinal row; lateral keels of scutellum more or less crimson, also a speck at the interobasal angle of clavus and a speck on the commissure about the middle. Leg spines black. Vertex about ½ to ¾ longer than broad, well produced in front of eyes, rounded anteriorly. Frons suboval, about twice as long as wide.

Length: 6½-6¾ mill.

Hab: Queensland, Cairns (viii), Kuranda (viii), arboreal.

2. *formosa* sp. nov.

Closely allied to the preceding but larger. There are six specks also on the vertex, but they are orange red and are arranged longitudinally in 3 rows of two each, the outer not being parallel but following the curve of the head, the middle two are on the carina (sometimes obsolescent) and are placed a little posterior to the corresponding lateral specks. The tegmina are speckled with crimson as follows: one each side on the commissure a little basal of its middle, and one or two at the anterior angle and 2 or 3 exteriorly—on the subapical line.

Length: 7⅛-7¼ mill.

Hab: Queensland, Bundaberg (ix-xii, i), Brisbane (xi), arboreal.

There is nothing remarkable, apparently, about the nymphal instars.

Daradax Walker.

Daradax Walker 1857 J. P. Linn S. London I, 85.

A beautiful nymph from Viti (iii) belongs, I think, to this genus.

Peltodictya, gen. nov.

Allied closely to *Epora* Walker, but the apical area of the tegmina is much longer, and there are two very distinct, though sinuate, subapical lines.

Vertex about twice as broad as long, extending a little in front of the eyes, rounded anteriorly, rectangularly emarginate posteriorly, strongly carinate medianly. Eyes prominent, but not extending laterally nearly as far as the pronotum. Frons more than twice as long as broad, strongly carinate medianly. Pronotum deeply acutangularly emarginate, with a strong median keel, and a lateral oblique one on each side. Scutellum longer than vertex and pronotum together, with 3 strong keels, the lateral ones sinuate, uniting anteriorly with the median. Radial and median veins nearly approximate at base, the former forking somewhat near the base, outer branch reforking; median not forked; cubital forked a little nearer the apex than the radial. Costal cell with about 12 simple crossveins; subcostal cell present. A large number of apical cells and about 8 subapicals. Tibiae with 3 spines.

(I do not think *Epora* Melichar is the same as *Epora* Walker, or as *Peltodictya*, as Melichar does not show even one clear subapical line.)

1. *kurandae*, sp. nov.

Grass green. Eyes and genital segments partly brownish. Veins lightly and shortly piligerous.

Length: $11\frac{3}{4}$ mill.

Hab: Queensland, Kuranda (viii) on grass.

Vanua, gen. nov.

Allied to the last described, but with only one at all regular subapical line, and the frons has oblique keels.

Vertex anteriorly rounded, transverse, extending a little in front of eyes, medianly carinate on the basal two-thirds; posteriorly acutely emarginate. Frons about twice as long as wide, medianly keeled on the basal three-fourths. Clypeus carinate medianly, the keel (at the apical margin of frons) proceeding straight on each side of median keel for more than half of frontal length, not quite reaching lateral keels. Clypeus keeled laterally. Pronotum wider posteriorly than head, carinate medianly, lateral keels curved convergingly, meeting anteriorly in an acute angle; anteriorly nearly on a level with anterior margin of eyes, posteriorly deeply acutely emarginate. Scutellum about as long as vertex and pronotum together, tricarinate; the lateral keels meeting anteriorly. Tegmina elongate, costal cell broadened posteriorly, with some 18 or 19 simple transverse veins; subcostal cell present. Radial forked near base, cubital forked close to it, a little nearer apical margin; median vein simple. Apical third of tegmina subreticulate. Tibiae with 3 spines.

1. *vitiensis*, sp. nov. (Pl. XXVII, figs. 7-9.)

Pale greenish testaceous; tegmina hyaline, veins more or less greenish testaceous.

Length: 10-11 mill.

Hab: Viti Isls. (iii), arboreal.

Nymphs: The vertex is angular anteriorly, and angulately emarginate posteriorly. The pronotum is acute-angled anteriorly, reaching almost to apical margin of eyes, posteriorly emarginate. Whole insect medianly carinate from apex of vertex to apex of abdomen. Ventrally, the frons is nearly twice as long as wide, carinate laterally and medianly, the latter keel not reaching anterior margin, and at visible base of frons sending out forks at right angles which curve around and meet again at apex of frons. The transverse space between this basal keel and the anterior margin of the vertex, is dorsal and is rounded anteriorly (as seen dorsally). It is crowded with sensory organs, and lightly keeled medianly. The space between lateral and sublateral keels on frons is also provided (much less thickly) with sensory organs. Eyes prominent. Nota and tegminal pads with a few sensory organs.

Pale greenish testaceous, a crimson stripe (or keel) from apex of vertex to apex of abdomen, broadening suffusedly as a rule about the middle of each part. A black spot at interoposterior angle of tegminal pad.

Length: 5 mill. (Pl. XXVII, figs. 6-7).

Rhinodictya, gen. nov.

Has a considerable superficial resemblance to *Hasta paupera*.

Head slightly ascending. Vertex about as long as pronotum and scutellum together, angularly emarginate at base, a lateral keel on each side and a median. Frons with a lateral keel on each side and a median, also a curved submedian keel on each side, becoming obsolete on the basal half. Pronotum tricarinate, angularly rounded anteriorly, deeply rectangularly emarginate posteriorly. Scutellum short, tricarinate, the lateral keels rounded, meeting anteriorly. Costa arched, costal cell with about 18 transverse veins; subcostal cell present, stigma absent. Apical fourth of tegmina reticulate, no definite subapical line. (Basal venation as in *Peltodictya*). Posterior tibiae with three spines.

1. *quaesitrix* sp. nov.

Pale yellowish green, paler beneath. Tegmina hyaline, veins pale yellowish green.

Length: 11-12 mill.

Hab: Queensland, Cairns (viii) on grass.

Family Achilidae.

The antennae in the Australian genera are small and inconspicuous.

1. Tegmina entirely bright red..............1 *Achilus* Kirby.
1a. Tegmina, if reddish, only so on the costal cell and the veins. .... 2.
2. Frons strongly impressed transversely; not or very obsolescently carinate. (A white band on the face)......................................2 *Aristyllis* gen. nov.
2a. Frons not impressed transversely; more or less strongly carinate medianly. ....3.
3. Apical cells of tegmina all (or all except one or two) not longer than wide..................10 *Salemina* gen. nov.
3a. Apical cells of varying length.........................4.
4. Vertex very transverse (not carinate medianly, and 2 white bands on the face).................4 *Pyrrhyllis* gen. nov.
4a. Vertex not transverse, or if so, very slightly............5.
5. Vertex obsolescently carinate medianly, somewhat deeply rotundately impressed in the middle..11 *Francesca* gen. nov.
5a. Vertex strongly carinate medianly; not impressed (or if so, longitudinally or very slightly, between median and lateral keels) ....6.
6. Lateral keels of frons meeting at its base and forming an angle there. ....5 *Majella* gen. nov.
6a. Lateral keels of frons not meeting at its base, which is more or less widely truncate (or slightly angularly emarginate). ....7.
7. Vertex basally practically truncate, except at extreme lateral margins. ....8.
7a. Vertex basally distinctly angulately emarginate.........9.
8. Vertex wider at base than long medianly.................................7 *Eurynomeus* gen. nov.
8a. Vertex distinctly longer than wide....6 *Phenelia* gen. nov.

9. Tegmina smooth, not granulate; veins thin and prominent, not granulate. Face with two transverse white bands..............................3 *Benella* gen. nov.
9a. Tegmina granulate on the costal cell and sparsely elsewhere, veins stout and prominent, granulate; frons not banded. ....9.
10. Head produced distinctly in front of the eyes........... ....8 *Argeleusa* gen. nov.
10a. Head not or very slightly produced....9 *Cythna* gen. nov.

Aneipo is not included in this table.

Achilus Kirby.

Achilus Kirby, 1818, T. Linn. Soc. London. XII. 474.
Achilius Spinola, 1839, Ann. S. E. France, VIII, 320.
Achillus Am. and Serv., 1843, Hemipteres, 524.

1. *flammeus* Kirby.

Achilus flammeus Kirby, op. cit. supra 475. Pl. XXIII, f. 13.
Hab: "Australia" (Coll. Kirkaldy.)

Aristyllis gen. nov.

Vertex slightly declivous, more or less confused with the frons; the lateral margins fork about their middle, (as seen dorsally), the inner keels meeting at an angle on the anterior margin (as seen dorsally), carinate medianly, posterior margin emarginate angulately. Frons obsolescently carinate medianly, the apical half excavated horseshoe-shaped. Clypeus more strongly carinate medianly, carinate (as also frons) laterally. A white opaque band across face. Eyes large, each about as wide as vertex. Ocelli distinct. Pronotum short, wider than head, tricarinate. Scutellum tricarinate. Tegminal venation as figured (all the Australian genera are very similar, differing principally in the relative proportions of the apical cells), not granulate. Legs spineless, or with one spine. Type *A. aristyllis*.

This genus is apparently *Plectoderes* Fowler (in part); I say "in part," because Fowler's genus is obviously heterogeneous. In *Plectoderes* Spin., the head is stated (and figured) to be fully as wide as the pronotum; in all the Australian Achilinae, the head is distinctly, often very much, narrower.

1. Scutellum anteriorly black; a white wedge across the middle of the clavus and a white stripe across costal cell. ....2 *omphale* Kirkaldy.
1a. Scutellum uniform dark or pale ferruginous; no white stripes on tegmina......................................2.
2. Scutellum dark ferruginous; a large bluish black spot near apex of costal cell................1 *aristyllis* Kirkaldy.
2a. Scutellum pale ferruginous; costal cell slightly infuscate. ....3 *adippe* Kirkaldy.

1. *aristyllis*, sp. nov.

Head gradually shading from brownish ferruginous at base of vertex (and also on apical half of clypeus) to black near apex of frons. Eyes and scutellum dark ferruginous. Anterior half of pronotum blackish, posterior half whitish. Sterna, rostrum and legs mostly testaceous, anterior femora black, the base and a band near the apex, pale. Abdomen mostly black. Tegmina subhyaline brownish-yellow, a tiny white speck about middle of commissure, the basal margin, a spot at base of costal cell, apical half of costal cell,and a spot about the middle of the clavus, blackish, with a metallic-blue glint; some of the veins sanguinescent. Rostrum reaching just beyond posterior coxae. Apical angles of vertical disk acute. Tibiae spineless.

Length: 4½ mill to apex of abdomen; 5¾-6½ to apex of tegmina.

Hab: Queensland, Kuranda (viii), Cairns (viii).

2. *omphale*, sp. nov.

Differs from the typical species by being shorter and broader and differently colored; vertex shorter.

Vertex, pronotum anteriorly in the middle, apex of clavus, pale ferruginous. Frons, clypeus, pronotum anterolaterally, anterior and posterior third of scutellum, sterna, abdomen, etc., black or blackish. Middle third of scutellum bright ferruginous, posterior margin of pronotum testaceous. Tegmina hyaline, pale yellowish brown, basal margin narrowly, a spot near middle of costal area, and a stripe across the clavus (nearer apex than base), opaque white; apex of costal cell more or less sanguineous, a large metallic bluish-black spot just basal of this. Anterior legs and intermediate and posterior femora more or less black, anterior femora not pallidly banded posteriorly, intermediate and posterior tibiae and tarsi widely pallid, at least apically. Frons banded as in the type. Vertex shorter than in the type, the apical angle of the disk rectangular; rostrum reaching to apex of posterior coxae.

Length: 4 mill to apex of abdomen; 5½ to apex of tegmina.

Hab: Queensland, Nelson (vii).

3. *adippe*, sp. nov.

Pale ferruginous, base and middle of frons blackish brown, banded with white as in the preceding species. Sterna and legs pale. Abdomen more or less marked with black. Tegmina pale yellowish hyaline, veins mostly darker, costal cell dark apically. Structure of head similar to the type. Legs not spinose.

Length: (male) 5⅛ mill.

Hab: Queensland, Cairns (viii).

Benella, gen. nov.

Characters of *Aristyllis*, but frons not excavated.

1. *aliena*, sp. nov.

Pale ferrugineous, face with two transverse white bands. Pronotum testaceous; tegmina hyaline, costal cell more or less infuscate; veins more or less pale sanguineous. Legs etc. pale, anterior and intermediate tibiae annulate with dark brown. Abdomen dark brownish black, posterior margin of each segment narrowly pale. Posterior tibiae with a spine.

Length: 3 mill to apex of abdomen; 4¾ to apex of tegmina.

Hab: New South Wales, Sydney (i).

Pyrrhyllis, gen. nov.

Allied to the preceding, but the vertex is very transverse and the frons is not impressed transversely; from *Phrygia* Stal it is apparently distinguished by the presence of a distinct keel separating vertex and frons.

Vertex not prominent, but more or less arched anteriorly, not reaching anteriorly as far as the eyes; very transverse, emarginate posteriorly. Frons a little convex, carinate medianly and laterally, as also clypeus. Face with two transverse white bands.

1. *pyrrhyllis*, sp. nov.

Pale yellowish testaceous, more or less pallidly infuscate. Scutellum infuscate between the keels. Abdomen mostly blackish. Tegmina hyaline, pale smoky, basal veins dark brownish, costa and apical veins sanguineous. Vertex rather obscurely keeled medianly.

Length: 3 mill to apex of abdomen; 4½ to apex of tegmina.

Hab: Queensland, Bundaberg (xi).

Majella, gen. nov.

Distinguished from any of the other Australian Genera, by the lateral keels of the frons meeting in an angle at the base, and the genae being subfoliaceous and dorsally prominent. General appearance of *Phenelia*, but the veins are strongly granulate, and the apical third of tegmen is more or less declivous. Posterior tibiae with a spine.

1. *majella*, sp. nov.

Pale cinereous or testaceous, a thin short dark brown line on vertex anteriorly on either side of median keel. Scutellum suffused with fulvescent, posterior part of keels pale yellowish. Tegminal veins mostly darker, thickly granulate all over, granules mostly pale; apex of clavus sanguineous with a large bluish-black spot; base of first apical cell sanguineous. Abdomen mostly brownish black. The lateral margins of the vertex converge slightly, but do not meet anteriorly. Frons posteriorly somewhat excavate, the lateral margins there being broad and subvertical.

Length: (male) 4; (female) 4⅝-5 mill.

Hab: Queensland, Nelson (vii), Cairns (viii).

Phenelia, gen. nov.

Allied to *Elidiptera* Spin., but differs by the vertex being strongly carinate in the middle, posterior tibiae not spinose, etc.*

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* *Elidiptera* Walker (not *Elidiptera* Spin., as Melichar states in his "Mon. Flatiden") is a synonym of *Phalaenomorpha* Am. Serv. (*Flatoides* Guerin, Melichar.)

Vertex longer than wide, produced before the eyes, lateral margins straight, slightly converging anteriorly, anterior and posterior margins truncate, strongly carinate medianly. Frons and clypeus as in *E. advena* Spin., except that the former is not so far produced basally. Pronotum and scutellum tricarinate. Tegmina in form similar to *E. advena*, but not quite so arched at the shoulder, not at all granulate; radial and cubital forked at about one-third of the length of the tegmen.

1. *elidipteroides*, sp. nov.

Head, pronotum, sterna and legs, yellowish testaceous, a little browner on vertex. Scutellum dark ferruginous. Tegmina hyaline, tinged with cinereous; keels of scutellum and basal veins of tegmina more or less obscurely sanguineous, apical and subapical veins, apex of costal cell and the entire apical cell adjoining, bright sanguineous; the base of that apical cell, bluish black. Abdomen mostly black.

Length: 2½ mill to apex of abdomen, 4½ to apex of tegmina.
Hab: Queensland, Cairns (vii-viii).

Eurynomeus, gen. nov.

Apparently somewhat allied to *Phrygia* Stal. Vertex slightly declivous, scarcely produced before eyes, subtruncate anteriorly, not shorter than wide; about one-half longer than the pronotum, medianly carinate, this keel extending to posterior angle of scutellum, though obsolescent on pronotum. Frons a little longer than wide, median keel extending to apex of clypeus, which is not very distinctly sutured off from frons. Pronotum posteriorly obtusangulately emarginate. Scutellum tricarinate. Tegmina not granulate, radial and cubital forked basally of the middle at about the same place. Posterior tibiae with a spine.

1. *australiae*, sp. nov.

Stramineous; a line on either side of median keel of vertex and a rectangular spot on each side of frons at base, a spot on mesopleura externally, black, lateral margins of pronotum and scutellum brownish. Tegmina hyaline, costa, etc., colorless, most of the rest pale smoky, a spot at the exteroapical angle and two or three veins between it and the costal cell, brownish. Tergites sordid yellowish, more or less lined with orange.

Length: 3 mill to apex of abdomen; $4\frac{3}{4}$ to apex of tegmina.
Hab: Queensland, Cairns (vii).

Argeleusa, gen. nov.

Allied to *Francesca* but with different head-form. Vertex longer than wide, distinctly produced in front of the eyes, rounded anteriorly. Frons elongate, lateral margins sinuate, concavely rounded basally, convexly rounded and widened apically; base narrow, obtuse-angulately emarginate. Tegminal veins, costal cell etc. granulate, veins thick and prominent. Tibiae obscurely spined near the base.

1. *kurandae*, sp. nov.

Pale olive brown, paler beneath. Vertex with four longitudinal blackish brown lines, frons and clypeus minutely mottled with brownish. Pronotum with a short blackish-brown line on each side of median keel and 5 spots of same color from thence to lateral margins. Scutellum between lateral keels minutely mottled with brownish, with 4 small, more or less distinctly ocellated spots, 2 anteriorly and 2 posteriorly. Tegmina hyaline, pale cinereous, veins pale brownish and white variegated, spotted with brownish especially on clavus costal cell and apical parts. Anterior and intermediate legs banded with pale brown. Abdomen more or less dark brownish.
Length: $5\frac{1}{2}$ mill.
Hab: Queensland, Kuranda (viii).

Cythna, gen. nov.

Differs from the last by the head being scarcely if at all produced before the eyes. The lateral keels of the vertex fork just before their middle, the outer forks diverging a trifle, the inner rounding gradually and meeting the median keel at the apical margin. Frons nearly as broad apically as long, narrowing a little towards the base. Tegmina granulate, apical third more or less declivous.

1. *laon*, sp. nov.

More or less pale ferrugineo-testaceous, vertex and scutellum more or less blackish about the keels. Scutellum also suffused with dark brown. Tegmina subhyaline, cinereous, mottled and granulate with blackish brown.

Length: 4½-4¾ mill.

Hab: Queensland, Cairns (viii).

I think another specimen (4¼ mill) from Kuranda (viii) belongs to this.

Salemina, gen. nov.

Vertex slightly declivous, convex, somewhat obscurely carinate medianly, sinuately rounded anteriorly. Frons elongate, lateral margins sub-parallel, slightly divergent posteriorly, carinate medianly. Tegminal veins thick, prominent, not granulate, apical cells short, the 3 middle ones scarcely longer than wide. Posterior tibiae with an obscure spine.

1. *francescophila*, sp. nov.

Cinereo-testaceous. Frons and scutellum very finely and somewhat closely speckled with dark brown. Pronotum tuberculate latero-posteriorly with blackish brown. Tegmina hyaline, cinereous, more or less finely marmorate with brown, veins on apical third whitish. Costa and apical margin of clavus, more or less closely spotted with blackish brown. Anterior and intermediate legs pallid, annulated with blackish brown.

Length: 5 mill.

Hab: Queensland, Cairns (viii).

Francesca, gen. nov.

Distinguished by the somewhat deep, circular impression on the middle of the vertex. Vertex longer than wide, produced a little in front of the eyes, the lateral margins forking near apex, making the apical margins tridentate, the median angle being acute. Pronotum with an impressed point on each side of middle keel, almost rectangularly emarginate posteriorly. Scutellum diamond shaped, much longer than the other genera.

1. *saleminophila*, sp. nov.

Sordid testaceous, frons laterally with a row of blackish brown spots. Posteriorly three-fifths of the disk of scutellum dark brown, lateral parts of scutellum (exterior to keels) with a large thin blackish brown subtriangular ocellus. Tegmina hyaline.

thickly spotted and smudged with brownish cinereous; veins on apical third white. Legs pallid, anterior and intermediate tibiae annulate with black. Abdomen brown, posterior margin of each segment narrowly pallid-sanguineous.

Length: 6 mill.

Hab: Queensland, Lucinda point (vii).

Ancipo, gen. nov.

Vertex with disk transverse, depressed, apically a little angulate, produced in front of the subrotundate eyes; basally roundly emarginate; lateral keels highly elevated, diverging a little posteriorly and continuing beyond base of disk. Frons widening apically, this part foliaceous and subvertical, acute, the disk medianly keeled. Clypeus laterally carinate curvedly, subfoliaceous. Pronotum much wider than the head, tricarinate, the lateral keels uniting anteriorly, the pronotum produced triangularly in the middle anteriorly. Scutellum tricarinate. Tegmina broad, rounded apically; costal cell broad, not transversely veined; radial and median veins approximating at base, the former forked about one-fifth of the length of the tegmina; cubital forking immediately basally of the forking of the outer radial. Apical cells short. Anterior femora and tibiae about equally long, posterior tibiae with one strong spine.

1. *diva*, sp. nov.

Bright pale yellow; pronotum (except laterally), clavus (except apical fourth and a spot near posterior angle of scutellum) and a stripe near apical margin of tegmina widening anteriorly, sanguineous. Scutellum brownish; sterna testaceous. Tegmina (especially costally) speckled with blackish brown. Wings milky white. Abdomen bright pale green.

Length: 6¼ mill to apex of abdomen, 11 mill to apex of tegmina.

Hab: Queensland, Kuranda (viii).

Fam. Derbidae.

1. Head (more or less) and anal vein of clavus (strongly) granulate....................(Subfamily Kermesiinae) 2.
1a. Anal vein not granulate (last segment of rostrum much shorter than the penultimate, widened, often annuliform ....(Subfamily Derbinae) 7.

2. Last segment of rostrum fairly long....................3.
2a. Last segment of rostrum subannuliform, conspicuously short ....6.
3. Head strongly carinate longitudinally in the middle...... ....1. *Phaconeura*, gen. nov.
3a. Head not carinate medianly............................4.
4. Lateral carinate of the head narrow and acute, sensory organs less conspicuous; pronotum not extending laterally farther than the antennae, not so far as the tegulae.....5.
4a. Lateral carinae broader and flattened, sensory organs conspicuous, pronotum extending laterally much farther than the antennae, farther than the tegulae................. ....4. *Phaciocephalus*, gen. nov.
5. Lateral carinae of frons (ventrally) parallel; vertex linear, widening out triangularly laterally......2. *Nisia* Melichar.
5a. Lateral carinae narrowing basally (ventrally); vertex linear entirely........................3. *Suva*, gen. nov.
6. Pronotum laterally foliaceous, sinuate, recurved, laterally almost enclosing antennae. Vertex triangular.......... ....5. *Basileocephalus*, gen. nov.
6a. Pronotum more or less normal, vertex truncate apically.. ....6. *Thyrocephalus*, gen. nov.
7. Antennae more than three times as long as wide.........8.
7a. Antennae not twice as long as wide.....................10.
8. Antennae more or less flattened, with very conspicuous sensory organs. ....9.
8a. Antennae subcylindric, sensory organs indistinct........ ....9. *Heronax*, gen. nov.
9. Head strongly elongate, curved and recurved, subascendant, length greater than that of nota.7. *Swezeyia*, gen. nov.
9a. Head foliaceous but not longer than nota, not recurved... ....8. *Phantasmatocera*, gen. nov.
10. Head wider than pronotum....10. *Philadelpheia*, gen. nov.
10a. Head narrower than pronotum......................11.
11. Tegmina elongate, narrow, nearly three times as long as wide...........................11. *Sardis*, gen. nov.
11a. Tegmina not more than twice as long as wide........12.
12. Lateral margins of frons practically contiguous between the eyes...13.
12a. Lateral margins of frons not nearly contiguous between the eyes...14.
13. Vertex extending far beyond the eyes..12. *Kaha*, gen. nov.

13a. Vertex extending but little beyond the eyes............ ....13. *Levu*, gen. nov.
14. Lateral margins of head noticeably sensorized.......... ....14. *Pyrrhoneura*, gen. nov.
14a. Lateral margins of head indistinctly sensorized......... ....15. *Rhotana*, Walker.

Nisia Melichar.

Nisia Melichar, 1903 Hom. Ceylon 53.

This genus seems to be but slightly differentiated from *Kermesia* Melichar. The last segment of the rostrum in both is not very short.

1. *atrovenosus* (Lethierry.)

Meenoplus atrovenosus Lethierry Ann. Mus. Genova. XXVI, 466.

Nisia atrovenosa Melichar 1903 Hom. Ceylon 53.

Hab: Queensland, Cairns (viii), Lucinda Point (vii); Viti Isles (iii); on grasses and sedges; also from Ceylon (my collection), Nias, Gunun, Sitol (Lethierry).

2. *grandiceps*, sp. nov.

Allied to the last ,but larger; the lateral margins of the head more highly raised. Head and nota sordid brownish testaceous, with a paler median line from apical margin of clypeus to posterior margin of scutellum.

Length: 2½-3 mill to apex of abdomen; 4¾-5 mill to apex of tegmina.

Hab: Queensland, Kuranda and Cairns (viii) on grasses and sedges.

Phaconeura, gen. nov.

Differs from *Nisia* by the head being strongly carinate longitudinally in the middle, and by the lateral margins being less elevated above the disk.

1. *froggatti*, sp. nov. (Pl. XXIX, figs. 5-6).

Piceous, tegmina paler, hyaline. Lateral margins and keels of head, pronotum and scutellum, clypeus, rostrum and legs, veins, tegminal granules, posterior margins of tergites etc., yellowish testaceous.

Length: 2½ mill to apex of abdomen, 4 mill to apex of tegmina.

Hab: New South Wales, Sydney (i).

1. *pallida*, sp. nov.

Differs from the type (*froggatti*), in being bigger and different in color.

Testaceous, scutellum (excluding keels) etc., fuscous. Abdomen blackish, except part of genital segment. Tegmina subhyaline milky, iridescent; veins whitish.

Length: 4½ mill to apex of tegmina.

Hab: Queensland, Bundaberg (xi).

Suva, gen. nov.

Closely allied to *Nisia*, but the lateral margins of the frons are not parallel. In *Nisia*, the vertex proper consists of a very narrow, linear strip, which widens out triangularly at the lateral margins; in *Suva*, this widening is absent, and the tegmina are narrower and more elonate.

1. *koebelei*, sp. nov.

Orange yellow, darker or redder on scutellum and sterna, legs paler. Eyes black. Tegmina subopaque creamy, veins pale orange yellow; clavus (except sutural cell) dark or redder, orange; a longitudinal entire submedian dark brown band, widening a little apically, on the tegmina and another along the commissure apical of the claval apex.

Length: 4-4¾ mill.

Hab: Viti Isles (iii).

Phaciocephalus, gen. nov.

Closely allied to *Suva*, but distinguished by the characters in the table.

1. *vitiensis*, sp. nov.

Sordid yellowish testaceous, lateral margins of scutellum broadly black, this continuing onto the tegmina in a broad median band, into which, near its middle, enters a narrow stripe arising near the extrobasal angle of tegmen. The ground color of tegmina is creamy, veins pale yellow. Legs pale sordid testaceous, apex of each segment narrowly black. Eyes and abdomen blackish.

Length: $4\frac{3}{4}$ mill.

Hab: Viti Isles (iii).

Basilocephalus, gen. nov.

Distinguished by the remarkable form of the pronotum. Head produced distinctly in front of eyes, vertex indistinctly separated from frons, the former elongate triangular, disk concave, the anterior converging lateral margins blunt, strewn thickly with sensory organs. Frons narrow, but the acute lateral margins not nearly contiguous. Clypeus rather longer than the head, stringly tricarinate. Antennae articulated remote from the genae, short, somewhat globose. Pronotum transverse, much wider than the head, medianly carinate, laterally foliaceous, recurved, practically enclosing the antennae except from in front. Scutellum polished, obsolescently carinate. Tegmina elongate, narrow. Tegulae subfoliaceous.

1. *thaumatonotus*, sp. nov.

More or less pale fulvotestaceous, a black spot on anterior ambulacra. Tegmina subhyaline, pale pinkish white, costal cell whitish, veins coralline, 2 or 3 more or less entire, narrow, dark brown longitudinal stripes on tegmina. Genital segment dark.

Length: 3 mill to apex of abdomen, $6\frac{1}{4}$ to apex of tegmina.

Hab: Queensland, Kuranda (viii).

Thyrocephalus, gen. nov.

Vertex a little longer than wide, produced in front of eyes, middle of the disk sunken, lateral margins widely flat and raised, strewn with sensory organs, converging slightly not meeting anteriorly, anterior margin truncate, posterior margin acute, elevated, truncate (the lateral margins are produced a little posteriorly beyond the base) posterolateral angles acute. Frons narrow, lateral margins acute, strongly elevated vertically, wider apically than basally, a little constricted medianly. Antennae short, rather smoothly subglobose. Pronotum wider than head, roundly rectangular posteriorly, somewhat obsolescently tricarinate, scutellum obsolescently 5-carinate. Tegulae extending laterally farther than pronotum. Costa granulate.

1. *leucopterus*, sp. nov. (Pl. XXIX, figs. 6-7).

Head, pronotum, legs etc., pale testaceous, frons more or less sordid. Scutellum pale yellow. Abdomen blackish posterior margin of each segment narrowly pallid. Tegmina and wings subopaque milky, apex of costal cell infuscate.

Length: 3-3½ mill to apex of abdomen, 5-6 to apex of tegmina.

Hab: Queensland, Cairns (viii), on grasses.

Swezeyia, gen. nov.

Vertex produced far in front of eyes, ascendant, somewhat recurved, narrowed in front of eyes and then gradually widened, subspatulate; deeply rectangularly emarginate basally, the angle of the emargination being on a level with the anterior margin of the eyes. Frons subconstricted at the eyes, widening out a little basally. Antennae elongate, flattened, about twice as long as an eye, set on each side of its disk with a raised mass of sensory organs. Clypeus obsolescently tricarinate. Pronotum acutangularly emarginate.

1. *lyricen*, sp. nov. (Pl. XXX, f. 10).

Pale yellowish, head and pronotum more testaceous. Antennal sensory organs dark gray. Eyes black. Pronotum sublaterally with a dark grey spot. Tegmina hyaline, greyish longitudinal stripe down the middle, some of the veins sanguineous.

Length: 2½ mill to apex of abdomen, 5¼ to apex of tegmina.

Hab: Viti Isles (iii).

Phantasmatocera, gen. nov.

Head elongate, extending well in front of eyes, frons and vertex confused; disk depressed, lateral margins highly elevated, subacute, converging towards anterior margin of head, but not contiguous either there or ventrally. Antennae much as in *Swezeyia*, but not so long nor quite so conspicuous. Pronotum acutangularly emarginate. Scutellum and clypeus obsolescently carinate. Tegmina narrow, elongate. Type *arborea*.

1. *arborea*, sp. nov.

Testaceous, a broad dark brown stripe laterally on genae through eyes to posterolateral angle of scutellum. Eyes and clypeus blackish brown. Tegmina hyaline, milky, a somewhat faint mediolongitudinal smoky stripe; some veins sanguineous, some yellowish.

Length: 2¼ mill to apex of abdomen, 5 to apex of tegmina.

Hab: Queensland, Kuranda (viii) on trees.

2. *vitiensis*, sp. nov. (Pl. XXVIII, figs. 1-3).

Closely allied to the type ,but the vertex is broader and not so convergent anteriorly; also the ventral part of the frons is practically parallel throughout, while in *arborea* it is narrower at the eyes, widening a little apically and basally. The eyes are also set closer to the clypeus and the antennae are shorter.

Pale yellowish, disk of head more testaceous; lateral stripe on head and nota as in *arborea*. Tegmina as in the latter, but the median stripe darker and more distinct.

Length: 5 mill.

Hab: Viti Isles (iii).

There are two or three other species from Cairns, etc., with different head structure but in imperfect condition for describing.

Heronax, gen. nov.

Allied to *Patara* Westwood* but the venation is different.

Head produced in front of eyes, vertex triangular, disk excavate, wider at base than an eye; there is no transverse carina dividing vertex from frons, but the latter is suddenly more shallow and the lateral keels are almost contiguous. Antennae articulated close to clypeus, second segment subcylindric, elongate, about three-fourths the length of the frons, not (or very slightly) sinuate apically. Scutellum with one (3?) obscure keel. Type *parnassius*.

1. *parnassius*, sp. nov.

Whitish testaceous, more or less sordidly infuscate. Tegmina with brownish spots on the costal cell, an irregular brownish band across tegmina (not costal cell) medianly, and the veins (at least partly) widely infuscate. Tibiae annulated with blackish brown.

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* The figure of the antenna of *Patara* in the Biologia Centrali Americana Hom. II (Pl. 9, f. 9 a) is obviously incorrect; Westwood says "Articulo primo annuliformi," as of course one would expect.

Disk of vertex deeply excavated, lateral margins narrowly flat. Apical of the eyes the frons widens out triangularly but is not so wide apically as the base of the ecarinate clypeus.

Length: 3¼ mill to apex of abdomen, 7 to apex of tegmen.

Hab: Queensland, Kuranda (viii) on trees.

2. *saccharivora*, sp. nov.

Allied to the type but the apical veins are mostly sanguineous, and the tegminal pattern is pale, and more broken. Lateral margins of frons contiguous throughout, and dorsally the head is much narrower and but narrowly excavated.

Length as in the type.

Hab: Queensland, Cairns (vii-viii) on *Saccharum officinale*.

Philadelpheia, gen. nov.

Distinguished by the big, wide eyes which extend laterally beyond the pronotum. Of the general appearance of *Zoraida* Kirkaldy.

Scutellum roundly declivous, head roundly perpendicular. Vertex and frons confused, consisting of a strongly elevated keel on each side and a very narrow area between, narrowing still more anteriorly. Eyes very large, very transverse, extending laterally slightly beyond lateral margins of pronotum. Antennae with second segment short, subglobular, a little wider apically than at base. Clypeus longer than the epicranium, strongly keeled medianly, more lightly sublaterally. Rostrum extending beyond posterior coxae. Scutellum tricarinate. Tegmina very elongate, venation dissimilar to any other genus. Posterior tibiae with one small spine, a little apical of the middle.

1. *pandani*, sp. nov. (Pl. XXI, fig. 3, and XXIX, figs. 8-9).

Head, median keel of clypeus, pronotum, keels of scutellum, disk of metanotum, legs, etc., whitish. A large lateral wedge on pronotum, interior half of eye, clypeus, etc., vermilion. Scutellum and metanotum (except as above) orange. Tegmina and wings pale brownish, hyaline, costal cell broadly pallid, clavus and base of corium more or less smoky, veins dark brown, the short transverse veins and exterior part sometimes of the others, broadly infuscate. Abdomen sordid testaceous, more or less marked with brownish.

Length: 3½-4 mill to apex of abdomen; 9½ to apex of tegmina.

Hab: Queensland, Cairns (viii) on *Pandanus*.

Sardis, gen. nov.

Allied to *Phenice* Westwood, but the tegmina are narrower basally, more elongate, and dilated apical to the clavus, head differently formed etc.

Scutellum strongly roundly declivous, pronotum vertical and head strongly bent under. Vertex short, separated by a smooth, confused line from the frons (of which the lateral margins are subcontiguous,) produced triangularly a little anteriorly, at base narrower than one of the transverse eyes. Antennae articulated close to exterolateral margin of genae and close to clypeus, which is as long as the epicranium and heavily carinate laterally. Pronotum deeply rectangularly emarginate. Scutellum strongly keeled in the middle.

1. *maculosa*, (Krueger). (Pl. XXVIII, figs. 4-6).

Phenice maculosa Krueger (?1897) Ber. Veruchsst. Zuckerr. West Java II, 243; and 1899 Das Zuckerrohr und seine Kultur 313; Zehnter 1897 Arch. Java Suikerind V. p. ? (Sep. 25).

Hab: Queensland, Cairns (viii), on *Saccharum officinale* and *Pandanus*. Originally recorded from Java.

Kruger (whose original work I have not seen) attributes it to Westwood, but I cannot trace any description by the latter.

Kaha, gen. nov.

Head produced more than their length in front of the eyes; vertex of frons somewhat confused, the former excavated as far as anterior margin of eyes, lateral margins acute and converging, meeting at anterior margin of eyes, continuing thence (somewhat nutantly) practically contiguous, as far as clypeus. Antennae large but short, with enormous sensory organs, giving the antennae a coralloid appearance. Pronotum carinate medianly, rectangularly emarginate, laterally subfoliaceous.

1. *perfecta*, sp. nov.

Testaceous, more or less infuscate; pronotum and scutellum pale castaneous, polished. Underside more or less sordid testaceous, abdomen blackish, posterior-margin of each segment pallid. Tegmina hyaline, more or less infuscate, costal cell apically chequered sanguineous and white; veins on apical half of tegmina sanguineous.

Lenth: 5 mill.

Hab: Queensland, Cairns (viii).

Levu, gen. nov.

Apparently related closely to *Paricana* Walker as figured in J. Linn. Soc. Zool. I, Pl. 8, fig. 1 (which however has apparently no connection with the generic description), but the apical veins are not forked close to the margin, etc.

Vertex and frons confused, extending well in front of the eyes disk greatly depressed, very narrow, long triangular, lateral margins acute and converging, meeting close to anterior margin of eyes, contiguous till past the eyes and then widening a little apically. Clypeus basally depressed. Eyes prominent, much wider than vertex. Pronotum deeply rectangularly emarginate. Tegmina narrow, elongate.

1. *vitiensis*, sp. nov.

Stramineous, eyes black. Tegmina milky white, subopaque, apical veins pale yellow, apical margin subsanguineous.

Length: 4¼ mill.

Hab: Viti Isles (iii).

Pyrrhoneura, gen. nov.

Vertex and frons confused, extending anteriorly before eyes, disk concave. Lateral margins acute, vertically elevated, dorsally they are thickly sensorized and converge straightly, not quite meeting anteriorly, posteriorly a little emarginate; ventrally they are elongate, narrow, a little wider apically. Antennae small, not articulated near clypeus. Ocelli present. Pronotum deeply angularly emarginate. Scutellum tricarinate.

1. *saccharicida*, sp. nov.

Vertex and frons yellowish testaceous, more or less suffused with sanguineous. Antennae clypeus and legs pale testaceous. Pronotum and scutellum sordid ferrugineous, laterally more or less suffused with sanguineous. Tegmina dark smoky, basally darkening more a large irregular blotch on the middle internally, the basal half of costal cell and 2 spots apical of this, 2 large spots on apical section, etc., white. Nearly all the veins bright sanguineous. Wings white with a large black spot almost covering apical half. Sternites blackish brown, posterior margin of each segment narrowly sanguineous.

Length: 3¼ mill to apex of abdomen, 5 to apex of tegmina.

Hab: Viti Isles, Rarawai Mills (iii), on *Saccharum officinale*. (Koebele's No. 2375.)

Rhotana, Walker.

Rhotana Walker 1857 J. Proc. Linn. Soc. London I, 160 (description only); Melichar 1903 Hom. Ceylon 61.

Genestia Stal 1858 O. V. A. F. XV, 450.

Walker's figure of the type (Pl. 8, fig. 2) has nothing to do with his description. Melichar has figured *R. vitriceps* (Stal.)

1. *chrysonoe*, sp. nov.

Differs from the three Sinhalese species and probably from the Bornean (from which it differs abundantly otherwise) by the short head which does not extend half the length of an eye beyond anterior margin of eyes. Pale luteous (metanotum and base of abdomen sanguineous in fresh example), rostrum, sterna, legs etc., paler. Tegmina and wings hyaline, iridescent; veins testaceous, faintly infumate broadly on each side of most of the transverse veins of the tegmina. Four tiny black specks on the radial vein. The subapical line is a little more irregular than in *R. vitriceps*.

Length: 2½ mill to apex of abdomen, 4½-4¾ to apex of tegmina.

Hab: Queensland, Kuranda (viii), arboreal.

2. *haematoneura*, sp. nov.

Ventral part of frons, smaller and narrower, less elevated laterally, etc.

Pale yellowish testaceous, scutellum more or less infuscate basally. Tegmina hyaline, largely clouded with brownish, veins sanguineous. Tergites infuscate.

Length: 5 mill.

Hab: Queensland, Kuranda (viii), arboreal.

Fam. Issidae.

There are two main divisions, characterized by the lateral form of the frons; this is however really not a sharp differentiation, *Gedrosia* Stal seeming to connect them. The Issinae have the lateral margins of the frons straight, or more or less rounded, while the Eurybrachyinae have them strongly, often acutely angulate. The former, moreover, are usually dull in hue, while the latter often have richly variegated tegmina and sometimes brightly colored wings. The aberrant genera *Tetigometra* Latreille and *Hilda* Kirkaldy should perhaps not be included in this family.

Subfamily Issinae.

Of this group some 60 genera have been erected, though many are still little known. It is not represented in the Hawaiian archipelago, but for Australia I record 6 genera and 13 species, of which 5 and 11 respectively are new. The Australian genera may be separated as follows:

1. Tegmina abbreviated, clavus not sutured off from corium (posterior tibia with one spine)......6 *Gelastissus* gen. nov.
1a. Tegmina complete, clavus sutured off....................2.
2. Tibiae with one spine; (tegmina tectiform)...5 *Lipocallia* gen. nov.
2a. Tibiae with 2 spines....................................3.
3. Wings rudimentary. ....4.
3a. Wings complete, not incised apically...................5.
4. Vertex flattish; cubital vein simple, median and radial veins forked near the base......4 *Hysteropterum* Am. Serv.
4a. Vertex concave; radial vein forked near the base, cubital and median veins forked the middle of the tegmina; (first segment of posterior tarsi very short)......3 *Sarnus* Stla.
5. Abdomen cylindrical; appearance Poekillopteroid..2 *Lollius* Stal.
5a. Abdomen depressed; appearance Cercopoid..1 *Issus* Fabr.

Issus Fabricius.

Issus Fabricius 1803 Syst. Rhyng., 99; Melichar 1896 Cic. Mittel-Eur. 40, Pl. III, figs. 22-5.

The following three species very probably will not be referred ultimately to the genus *Issus*, as the frons and clypeus do not altogether lie in the same plane. They cannot be *Ulixes* Stal, as in that genus the scutellum is said to be twice as long as the pronotum.

1. *vulturnus*, sp. nov.

Vertex, pronotum and scutellum testaceous of various degrees of sordidness; frons and clypeus sordid brown. Tegmina dirty brownish, a transverse band (a little basal of the middle), the commissure, etc., dirty whitish. Legs dirty brownish, paler in places. Beneath sordid. Wings dark smoky. Vertex slightly transverse (apical margin very obtusely angulate), narrower than an eye. Frons with a round sublateral carina, and also a median longitudinal one, both slight but noticeable; posterolateral angles rounded, posterior margin roundly emarginate; outside the round carina are small granules. Eyes, in profile, occupying nearly the whole of the head as far as the antennae. Pronotum granulate, medianly carinate. Tegmina about 3 times as wide (max.) as head and eyes together; veins strong, with numerous strong transverse veinlets (including costa and clavus). Cubital and median veins forked at about the middle.

Male: Pygofers black, polished, short, acute.

Length: 6 mill., maximum width 3 mill.

Hab: Queensland, Brisbane (vi), arboreal.

2. *sidnicus*, sp. nov.

Allied to the previous species, but smaller. The colorings and picturation are practically the same except that within the round carina of the frons, the color is castaneous, suffused with blackish on the disk, and there is a short, transverse, whitish stripe in the middle. Vertex about as wide as an eye, a trifle more transverse than in *vulturnus*; scutellum scarcely longer than the pronotum. Frons longer than wide, more swollen medianly and more granulate outside the round carina, lateral margins less divergent. Cubital vein forked a little nearer the apex than the median.

Male: Pygofers similar to the previous.

Length: 5¼ mill.

Hab: New South Wales, Sydney (i), arboreal.

3. *ridicularius*, sp. nov. (Pl. XXXI, f. 4).

Somewhat allied to *T. sidnicus*, but scarcely congeneric. Sordid testaceous, base of frons, apex of clypeus etc. dark. Abdomen, legs, etc., more or less obscurely and sparsely marked with brownish within the reticulations, exterior veins more or less greenish, or blackish. Vertex and eyes rather flatter and a little wider. Head and eyes as wide as, or a trifle wider than, the pronotum; costal margin more evenly rounded. Frons flatter, lateral keels straight, posterior keel obsolescent. Pronotum not granulate. Median and cubital veins forked at about the same place.

Male: Pygofers as in the previous species.

Female: Last segment almost linear, pygofers pale brownish, short, broad, the two together almost equilateral.

Length: About 6 mill.

Hab: Queensland, Cairns (viii), Bundaberg (ix-xii), arboreal. The Bundaberg specimen is the type.

4. *elongatulus*, sp. nov.

Scarcely congeneric with the three preceding.

Pale greyish cinereous, vertex and pronotum a little marked or suffused with green. Veins pale olive brown. Elongate, narrower; head, pronotum and scutellum not, or scarcely, granulate. Anterior margin of vertex truncately carinate, anterior to this (dorsally) is visible a small, rounded, part of the frons. Frons a little wider posteriorly than anteriorly, furnished with a circular carina and a medio-longitudinal straight one; posterolateral frontal angles rounded. Tegmina narrow, elongate, not so reticulate as in the preceding species, costa little widened, the radial vein forks almost immediately after its inception, the outer branch sinuate; the median vein forks apical of the middle, outer branch reforking; the cubital forks about the middle.

Length: 5½-6 mill., width 2-2⅓ mill.

Hab: Queensland, Cairns (viii), arboreal.

Lollius Stal.

Lollius Stal 1866 Hem. Afr. IV, p. 209; and 1870 O. V. A. F., p. 763.

Stal states that the pronotum ("thorax" as he invariably terms it) is truncate; in the two species described, it is widely rounded.

1. *australicus*, Stal.

Lollius australicus Stal 1870, O. V. A. F., 763.
Hab: Queensland, Moreton Bay.
Unknown to me.

2. *angustifrons*, sp. nov.

Distinguished from *L. australicus* by the elongate frons; (in that species it is "almost as wide as long.") Greyish testaceous, vertex, lateral margins of frons (spotted with testaceous), markings on clypeus, etc., middle part of pronotum and of scutellum, extreme base of clavus, some obscure, small, markings on tegmina (especially on apical and costal margins), some more or less obscure markings on legs and abdomen—blackish. Underside yellowish testaceous, frontal carinae pale ferruginous. Tegminal veins more or less closely speckled with sanguineous. Wings pale smoky. Vertex a little longer than wide; lateral margins of vertex and frons acutely elevated vertically; on the front within these are 3 carinae united basally acutangularly, diverging a little posteriorly and roundly uniting again. Frons nearly twice as long as wide, wider posteriorly than anteriorly. Rostrum reaching to posterior coxae. Upper apical angle of tegmina about right angled.

Length: 8 mill., height in profile about $4\frac{1}{2}$ mill.
Hab: Queensland, Bundaberg (xi), arboreal.

3. *acutipennis*, sp. nov.

Closely allied to *L. angustifrons*, but smaller, and the upper apical angle of tegmina distinctly acute and more prominent; the anterior carina of vertex truncate, and more pronounced (it is feeble and excavately angulate in *L. angustifrons*). The veins are not, or very scarcely, marked with sanguineous.

Length: $5\frac{1}{3}$ mill., height $3\frac{7}{8}$ mill.
Hab: Queensland, Kuranda (Type viii), Nelson (vi), arboreal.

Hysteropterum, Am. Serv.

Hysteropterum Amyot & Serville, 1843, Hemipteres, 519.
1. *H. dorsale* Walker, 1851, List. Hom., 375.
2. *H. truncatellum* Walker op. c., 377.

Unknown to me; as Stal does not mention them, I presume they are rightly placed in the above genus.

Sarnus Stal.

Sarnus Stal., 1886, Hem. Afr., IV, 204.

The type is stated by Stal (Berlin. Ent. Zeit., X, 392) to be *Issus decipiens* Spin., a species the description of which is unknown to me. One specimen was collected, which I refer to this genus.

1. *lucindae*, sp. nov.

Head pale ferruginous, somewhat obscurely speckled and granulate with pale yellowish; pronotum and scutellum sordid brownish, anterior two-thirds of latter pale yellowish brown. Tergites more or less black, genital segments pale, sternites sordid brownish. Tegmina pale cinereous, veins brownish, a brownish smudge across middle and a brownish spot on costal margin near apex. Legs pale, strongly and widely annulate with black. Vertex transverse, a little wider than an eye, anteriorly widely obtuseangled, posteriorly widely obtuse angularly emarginate. Frons flat, with an obscure circular keel, granulate between this and the base. Pronotum granulate, scutellum little longer than the pronotum, smooth, with a deep puncture on each side. Tegmina narrow, elongate, subcoriaceous, costal margin close to base, then widened roundingly; veins strong.

Length: 3⅓ mill.

Hab: Queensland, Lucinda Point (vii), probably arboreal.

Lipocallia, gen. nov.

Allied to *Neaethus* Stal but the tegmina are subcoriaceous, lateral carinae of the frons are as well developed as the median, the costal area is reticulate, etc.

Vertex transverse, almost linear, truncate apically. Frons quadrangular, perpendicular; lateral margins slightly sinuate, narrowing a little just basal of the clypeus, with 2 lateral curved carinae (forming an oval) and a longitudinal median one, all of equal strength. Pronotum very transverse, slightly arched anteriorly, slightly roundedly emarginate posteriorly, medianly carinate longitudinally. Scutellum nearly 3 times as long as pronotum. Tegmina tectiform, covering body completely. Corium more or less convex, costal area dilated, a little sinuate.

Tegmina closely reticulate, more minutely costally, apical margin roundly obliquely truncate.

1. *australensis*, sp. nov.

Head, pronotum, etc., testaceous, very closely and finely mottled with dark brown. Tegmina whitish testaceous, many of the recticulations wholly or partly brownish. Legs mostly blackish brown. Tergites black and white alternately. Genital segments black.

Length: 3½ mill., height 2¼ mill.

Hab: New South Wales, Sydney (i-ii), arboreal.

There is sometimes a more or less obscure blackish band across the middle of the tegmina.

Gelastissus, gen. nov.

Somewhat allied to *Peltonotellus* Puton. Vertex flat or slightly concave, posteriorly truncate. Eyes very large, extending practically as far as the base of the pronotum. Frons at about right angles to the vertex, narrow, elongate, strongly and elevately carinate medianly with a lateral keel on each side, and a more or less obscure, sometimes obsolescent, curved keel on each side between the others, forming an elongate oval. Pronotum transverse, anterior and posterior margin truncate, medianly carinate, also a carina on each side close to the eye. Scutellum about twice as long as pronotum, tricarinate. Tegmina strongly abbreviate, venation obscure, clavus not sutured off, radial, cubital and brachial veins apparently all joined close to base. Legs simple. Type *albolineatus*.

The three Australian species are easily separable as follows: (It is possible that 2 and 3 are not congeneric with the first):

1. Blackish brown, with an entire, white longitudinal line. .... 1 *albolineatus*.
1a. Tergites apically sanguineous .... 2.
2. Tegmina opaque, blackish .... 2 *histrionicus*.
2a. Tegmina translucent, pallid .... 3 *suffusus*.

1. *albolineatus*, sp. nov. (Pl. XXIX figs. 1-2.)

Blackish, more or less shining; a white longitudinal stripe from apex of vertex to apex of abdomen and a lateral stripe of same color from apex of propleura to apex of abdomen. Genae, clypeus laterally, legs, abdomen partly, pale testaceous.

Vertex flat, twice as long as pronotum, obtusangulate and a little prominent apically. Tegmina opaque, reaching to about one-half of the length from base of pronotum to apex of abdomen.

Length: 3¼ mill.

Hab: Queensland, Cairns (vii-viii), Koebele's No. 2257, from grasses on damp ground.

2. *histrionicus*, sp. nov.

Vertex, pronotum and scutellum brownish piceous; frons, carina of clypeus, tegmina etc., shining black; sides of clypeus, genae, underside more or less, legs, etc., testaceous. Tergites mostly testaceous, 3 apical segments pale sanguineous.

Smaller and more elongate than *G. albolineatus*, vertex more concave, shorter, scarcely longer than pronotum, not produced in front of eyes, apically subtruncate. Tegmina opaque, more rounded costally, reaching to about two-thirds of the length from base of pronotum to apex of abdomen.

Length: 2½ mill.

Hab: Queensland, Cairns (viii, No. 2272), from grasses on dry ground.

3. *suffusus*, sp. nov.

Closely allied to *G. histrionicus* but I do not think it is an immaturely coloured form of that species.

Pale testaceous; vertex, pronotum and scutellum more or less suffused with pale sanguineous. Tegmina shining, translucent. Tergites pale yellow testaceous, base and 3 apical segments pale sanguineous.

Length: 2½ mill.

Hab: Queensland, Cairns (viii), probably on grasses.

N. B.—I do not possess the description of the following species, but suppose that it belongs to the Issinae:

1. *Alleloplasis darwini* G. B. Waterhouse 1839 T. E. S. London II.

Subfam. Eurybrachyinae.

Of this group some 20 genera have been proposed; they are unknown in Hawaii, but 7 genera and 25 species are recorded from Australia, of these 3 and 5 respectively are now described as new.

The Australian genera may be separated as follows: They all belong to the sub-group with closed clavus:

1. Antennae reaching plainly beyond eyes.................2.
1a. Antennae not reaching as far............................3.
2. Frons transverse, angulate laterally.......4. *Dardus* Stal.
2a. Frons scarcely wider than long, roundly ampliate on each side ....1. *Gedrosia* Stal.
3 Pronotum and scutellum together about as wide as long ....2. *Platybrachys* Stal.
3a. Pronotum and scutellum together, wider than long......4.
4. Frons strongly carinate and excavate.................. ....6. *Gelastopsis*, gen. nov.
4a. Frons flat or only slightly rugose; lightly carinate.......5.
5. Tegmina elongate, narrow....5. *Euronotobrachys*, gen. nov.
5a. Tegmina shorter, broader..................3. *Olonia* Stal.

The Australian Eurybrachyini are probably all *Eucalyptus*-feeders; *Euronotobrachys arcuata* was found always in grass, but it had probably been blown or fallen from *Eucalyptus*.

Gedrosia Stal.

Gedrosia Stal 1862 O. V. A. F. XIX 448.

1. *Eurybrachys varia* Walker 1851, List. Hom. 394.
Unknown to me.

Platybrachys Stal.

Platybrachys Stal 1859 Eugenie's Resa. Ins. 280, and 1861 K. Vet. Ak. Handl. 3 No. 6, p. 67 and 1862, O. V. A. F. XIX 448.

A large number of Australian species have been described, none of which however have I been able to identify. In the first work cited, Stal figures the type, but the structure of the head and of the clavus are not like any Australian forms I have seen; in the second work the genus is included among the forms with open apex to clavus; in the third (one year later) among those with closed apex! In the forms about to be described the clavus is closed, but is not acute. The genus is badly in need of revision.

1. *oculata*, sp. nov.

Head testaceous, sometimes tinged with olive brown; pronotum and scutellum sordid castaneous, abdomen mostly black; anterior and intermediate legs castaneous, except the black, foliaceous part of the anterior tibiae; posterior legs black. Tegmina reddish castaneous, apical margin narrowly smoky, a small black spot near the apex, with three tiny white specks enclosed, and a narrow testaceous line from this spot to costal margin, (or there may be two or three black spots, each encircling white specks, or there may be no white specks; apical margin often more broadly dark.) Wings dark smoky. Vertex rather less than twice as broad as long.

Length: 11-12½ mill.

Hab: Queensland, Cairns (viii), Nelson (vii), Brisbane (vi).

2. *chlorocephala*, sp. nov.

Similar to *P. oculata* but head pale bright green, an additional black spot on tegmina, about middle of costa; posterior legs sordid brownish. Vertex more than three times as wide as long.

Length: 12 mill.

Nab: New South Wales, Sydney (ii).

3. *sicca*, (Walker).

Eurybrachys sicca Walker, 1851, List. Hom., 384.

E. rubiginea Walker op. c., 386.

E. semisicca Walker op. c., 387.

An example from Queensland, Cairns (viii) and some from Bundaberg (xi) seem to be var. *rubiginea*, but Walker's descriptions are too unsatisfactory for certain determination. It is probably not congeneric with *P. oculatus*.

The following species have been described from Australia:

4. *Eurybrachys decemmacula* Walker, 1851, List., 389. (=*Aphana lanifera* Stal., 1854, O. V. A. F., 244, type of genus, figured in Eugenie's Resa. Ins. Pl. IV, f. 8).
   Hab: New South Wales, Sydney.
5. *E. maculipennis*, LeGuillou, 1841, Rev. Zool. 261. (The description is unknown to me.)
6. *E. sera* Walker List., 385=*semilimpida* Walker, 387. Queensland (?), Port Essington.
7. *E. leucostigma* Walker, 388.
8. *E. decisa* Walker, 389.
9. *E. sanguiflua* Walker, 1858, suppl. 330.
10. *P. signata*, Distant, 1892, Tr. E. S., London, 281.
11. *P. insignis*, Distant, op. c. 282.

12. *P. aerata*, Distant, op. c. (Also from Samoa).
13. *P. lugubris* Stal, 1863, Stett. Ent. Zeit., XXIV, 249. Queensland, Moreton Bay.
14. *P. vidua* Stal l. c., (same locality).
15. *P. aegrota* Stal op. c., 250.

Olonia Stal.

Olonia Stal., 1862, O. V. A. F., 488.

1. *picea*, sp. nov.

Distinguished from *O. rubicunda* Stal. by the shorter vertex; from *O. transversa*, by the absence of conspicuous markings on head and pronotum and by the different coloring of tegmina; from *O. apicalis*, by the absence of curved furrow and row of impressions on vertex, etc.

Piceous; sterna, abdomen and basal half of posterior femora, sanguineous. Tegmina piceous, the disk ferruginous more or less darkened in places, a short white stripe near the apex (sometimes obsolescent). Wings dark smoky.

Vertex and eyes a trifle wider than pronotum, the first named about four times as wide as long; frons irregularly longitudinally rugulose.

Male: Genital segment dark.

Female: Genital segment pale; a large white spot on costa, anteriorly.

Length: (male) 7-7¼; (female) 7½-8 mill.

Hab: Queensland, Cairns (vii-viii).

The following three species have been described from Australia:

2. *Eurybrachys rubicunda* Walker, 1851, List. Hom., 391; Queensland, Sandy Cape.
3. *E. apicalis* Walker, op. c., 393; Northwest Coast.
4. *E. transversa* Walker, 1858, Suppl., 96; Queensland, Moreton Bay.
5. *O. viridiventris* Stal 1863 Stett. E. Zeit., XXIV, 250; Queensland, Moreton Bay.

Dardus Stal.

Dardus Stal., 1859, Eugenie's Resa Ins., 279; and 1861, K. Vet. A. K. Handl. 3, No. 6; 67 and 1862, O. V. A. F., 488.

1. *immaculatus*, sp. nov.

Piceous, immaculate. Carinae on head, pronotum, etc., and veins (mostly) dark castaneous. Pleura, abdomen and posterior femora sanguineous; rest of legs obscurely marked with pale brown.

Lateral angles of frons much more produced than in Stal's figure of *D. abbreviata.*

Length: $5\frac{7}{8}$ mill.

Hab: Queensland, Brisbane (vi).

2. *abbreviata* (Guerin).

Eurybrachys abbreviata Guerin, 1838, Voy. Coquille, 190.

E. lacta White, Eyre's Expd. Austral. Appendix, 433, Pl. 4, f. 3.

E. rufiventris Stal., 1858, O. V. A. F., 191. (Figured in Eugenie's Resa. Ins., Pl. IV, f. 7.)

Hab: New South Wales, Sydney (ii).

The curious nymph is figured on Pl. XXIX fig. 5.

The following species have also been described:

3. *Eurybrachys bufo* Walker, 1851, List. Hom., 393.
4. *Dardus albomaculatus* Distant, 1892 Trans. Ent. Soc. London 282.
5. *D. obscurus* Distant, op. c. 283.

Euronotobrachys, gen. nov.

Allied to *Olonia* Stal. Somewhat of the form of *Nicidus* Stal, but the tegmina and wings are shorter and the clavus is apically acuminate and closed, the wings are also broader basally. Antennae short. Scutellum with three carinae. Anterior tibiae with three spines. Type *E. arcuata.*

The two species are separable thus:

1. Vertex a little more than twice as long as wide;
   Length: 8 mill. . . . . 1 *arcuata* sp. nov.
2. Vertex more than three times as long as wide;
   Length: $10\frac{1}{2}$ mill. . . . . 2 *plana* sp. nov

1. *arcuata*, sp. nov.

Pale yellowish ferruginous, marked with blackish brown, the frons freckled with dirty brown. Sterna and abdomen sanguineous. Tegmina pale ferruginous, irregularly and sordidly spotted with blackish brown, especially apically; costa near apical angle and the apical margin (except extreme) hyaline a pale yellowish transverse band near base. Wings dark smoky. Legs black, obscurely and sparsely marked with yellowish brown.

Vertex a little more than twice as long as wide, longitudinally striate, roundly arched anteriorly. Face wider than long, acutangulate laterally, a transverse round-oval carina on the disk. Tegmina postero-apically almost rectangular, posterior angle extending further out than the rounded anteroapical angle.

Length: 8 mill.

Hab: Queensland, Cairns (vii-viii).

2. *plana*, sp. nov.

Ferruginous, irrorated with black, a black blotch on the middle of the clavus; tegmina irregularly and undulatingly striped narrowly longitudinally, etc., with black, a hyaline transverse line near apex; veins mostly ferruginous. Face and legs black, the former minutely and obscurely marked with testaceous, the latter with ferruginous. Sterna and abdomen sanguineous.

Larger than the preceding, the vertex wider (more than three times as wide as long) and less arched. Frons not so angular laterally, about as wide as long, with a rounded carina. Tegmina rounded apically.

Length: 10½ mill.

Hab: Queensland (viii).

Gelastopsis, gen. nov.

Of the general form of *Euronotobrachys* but with a very different frontal structure and longer antennae; allied to *Dardus* but with different frontal and tegminal form.

Dorsal part of head a little irregularly arched anteriorly, below this a sinuately arched carina; the space thus enclosed about three times as wide as long. Head and eyes a little wider than pronotum. Frons transverse, much wider than long; lateral angles roundly acute. It is divided transversely into two areas of different color and texture—the anterior area has a large rounded carina and a straight median one, all these being thickened and deepened, the depths being longitudinally striate. The anterior margin of the posterior area is boldly sinuate; sublaterally the disk is transversely carinate. Pronotum broader than length of pronotum and scutellum, the latter tri-carinate. Costa strongly arched basally, the rest of the tegmina being parallel sided, upper apical angle rounded, not extending quite so far as the subrectangular lower apical angle. Anterior and intermediate tibiae and tarsi dilated, posterior tibiae trispinose.

1. *insignis*, sp. nov.

Vertex, pronotum and scutellum yellowish brown, marked with brownish black; anterior area of frons black, posterior area yellowish, variegated with brownish. Clypeus reddish variegated with yellowish. Meso and metasterna and abdomen sanguineous, the last named more or less black dorsally. Tegmina ferruginous, costally and apically blackish; a line near base of corium, another close to anterior margin of tegmina and a shorter one on costa a little basal of the last named, pale yellowish; also various more or less obscure yellowish spots. Veins ferruginous, apically more or less blackish. Wings dark smoky black. Anterior and intermediate legs blackish brown, variegated with ferruginous; posterior femora sanguineous; tibiae ferruginous.

Length: 8½-9 mill.

Hab: Queensland, Brisbane (vi).

The following is unknown to me:

1. *Lyncilia nobilis* Stal 1863, Stett. Ent. Zeit., XXIV 248. Lizard Island.

Fam. Poekillopteridae.

This family consists of three subfamilies separable as follows:

1. Clavus granulate; posterior tibiae with one to three spines. ....3 *Pockilloptcrinac.*
1a. Clavus not granulate..................................2.
2. Posterior tibiae with 2 to 4 spines...........1 *Ricaniinae.*
2a. Posterior tibiae spineless................2 *Amphiscepinae.*

Subfamily Ricaniinae.

Very little material in this group was collected; it is not known in Hawaii, but 11 genera and 18 species are recorded from Australia, one new species being now described. The group has been monographed recently by Melichar

Euricania Melichar.

Euricania Melichar 1898 Ann. Mus. Wien. XIII, 204 and 258.

A genus of 11 species from New Guinea and adjacent islands, Viti, China, Japan and India.

1. *tristicula* (Stal).

Ricania tristicula Stal, 1865, O. V. A. F., XX, 163.

Euricania tristicula Melichar, op. cit. supra 265, Pl. XI, figs. 7 and 20 and Pl. XIII, f. 14.

Privesa Stal.

Privesa Stal, 1861 K. Vet. Ak. Handl. 3 No. 6, p. 70 Melichar 1898, op. c. supra 282.

A widely distributed palaeotropical genus of 9 species.

1. *aphrophoroides* (Walker).

Dechitus aphrophoroides Walker 1862 J. Ent. 1, 311 Pl. XV, f. 7.

Hab: Queensland, Moreton Bay (Walker); Bundaberg (ix-xii), Brisbane (vi and xi).

Exceedingly common.

Another species has been recorded from Australia, viz.: *P. exuta* Melichar, p. 284, Pl. XII, f. 4 and Pl. XIII, f. 9, from Queensland, Cape York, Moreton Bay and Gayndah (not Gayndak as Melichar quotes).

Scolypopa Stal.

Scolypopa Stal, 1859 Berlin, Ent. Zeit. III, 325; Melichar, p. 278.

An Australian, Oceanian and Madagascan genus. Melichar (p. 278) says: "Apicalrand nur halb so lang wie die Sutura Clavi." In this he is obviously wrong and has more correctly expressed it on page 205 "Kaum laenger."

1. *australis* (Walker). (Pl. XXI, f. 1).

Pochazia australis Walker, 1851 List. 430; Froggatt 1900 Agr. Gaz. N. S. W., XI, 650; Pl. (no number), fig. 6; T. W. Kirk, 1903, Eleventh Rep. Agr., New Zealand, 437; text-figs. 1-4.

Scolypopa australis Melichar, p. 278, Pl. XI, f. 24.

Hab: Queensland, Bundaberg (ix-xii); Moreton Bay (Melichar); New South Wales, Sydney (i); New Zealand, Palmerston North (my collection), etc.; Viti (Froggatt).

Commonly distributed on several plants, especially "Passion fruit vines" and ferns; it is somewhat of a pest.

2. *kurandae*, sp. nov.

Not very closely allied to any other species.

Brown; eyes pale reddish striped narrowly sub-concentrically with violet brown. Mesonotum blackish, carinae red brown. Beneath pale yellowish. Tegmina dark brown, a few of the nervures paler; one or two short, more or less obscure, darker transverse fasciae, a whitish triangular spot on the costal membrane; costal membrane and apical margin blackish.

Frons with five distinct carinae, the sublateral keels being much more distinct than in *A. australis*. Rostrum short, scarcely reaching to intermediate coxae.

Length: 8 mill.

Hab: Queensland, Kuranda (viii); one example on a dwarf *Casuarina* in a rocky, wind-swept place on the banks of the Baron River.

3. *scutata* Stal.

S. scutata Stal. 1859, Berlin Ent. Zeit. III, 26; Melichar 280, Pl. XI, f. 28.

Unknown to me.

Gaetulia Stal.

Gaetulia Stal, 1864 Stett. Ent. Zeit. XXV, 54; Melichar 327.

Probably cosmo-tropical.

1. *chrysopoides* (Walker).

Ricania chrysopoides Walker, 1862, J. Ent. I, 312.

Allied to *G. nigrovenosa* Mel., but differing by the form of the vertex which is wider than long, and by the color. I have little doubt as to the correctness of the determination, though Walker describes the vertex as 'transverse quadrate'; it is, in fact, obtuseangulate anteriorly and correspondingly emarginate posteriorly.

Hab: New South Wales, Sydney (i).

Epithalamium, gen. nov.

Differs from *Armacia* Stal by the radial vein not being forked near the base.

The tegmina are broad, nearly as broad as long, and rounded apically; the radial vein is joined to a refurcation of the median by a slight, transverse vein, a little basal of the middle; apical of this the radial forks, the outer branch being joined almost immediately by a slight, transverse vein to the exterior subapical cell (which is curved and encroaches on the costal cell apically). The median vein forks at about a third the length of the tegmen. There is a fairly regular subapical line, and two very irregular transverse lines basal of this.

1. *aziola*, sp. nov.

Head, pronotum and scutellum pale ferruginous; underside and the legs paler. Tegmina hyaline, veins blackish brown, pale ferruginous and whitish; costal cell (the transverse veins pale), basal half and a spot at apex of subcostal, basal cell, clavus, a long spot about the middle of the tegmina, apical margni broadly (except a small hyaline spot at the apex of some of the cells), and a narrow oblique band nearer to the apex than the middle, broadening and darkening costally, more or less dark smoky. Wings hyaline, marginally smoky. Abdomen basally black.

Length: About 5½ mill.

Hab: New South Wales, Sydney. (Koebele's No. 2367).

Unfortunately only a single, stylopized, female of this pretty Ricaniine.

The following Ricaniinae are Australian:

Ricania Germar.

1. *confusa* Melichar 220 and 227; Queensland.

Ricanoptera Melichar.

1. *extensa* Mel., 254 and 255.
2. *patricia* Mel., 264 and 257. Queensland.
3. *prominula* Schmidt 1905 Stett. E. Zeit., LXVI 189, Queensland.

Plestia Stal.

1. *Ricania marginata* Montrouzier, 1861, Ann. S. E. France, (4) I, 73; figured by Melichar; Pl. XIII, f. 17 and Pl. XIV, f. 1; (also from *Viti* and *Lefu*).

Nogodina Stal.

Cixius pallidipennis Guerin, 1838, Coquille II, 189; figured by Melichar, Pl. XIV, f. 4.

New South Wales, Port Jackson; (also from Vanikoro, Amboina, etc.)

Salona Stal.

1. *Cixius panorpaepennis* Guerin, 1838, Coquille, 190; figured by Melichar, Pl. XIII, f. 2.

New South Wales, Port Jackson; Tasmania.

Pucina Stal.

Cixius pellucidus Guerin, 1838, Coquille, 189; and 1844 Icon. R. Anim. 358, Pl. 58, f. 4.

(Recorded also, probably in error, from India and Java).

Also the following of uncertain generic position:

1. *Flatoides aperiens* Walker, 1858, Suppl., 103; Viti; Nauai.
2. *Flatoides stipatus* Walker, 1851, List, 411.

The second group, Amphiscepinae, is not found in the Australasian regions.

Subf. Poekillopterinae.

This group of, usually, greenish or variegated, Fulgoroidea, is probably fairly well represented in Australia, although only 11 Genera and 22 Species have, up to the present been recorded. 2 Genera and 17 Species are now added, and this number could have been materially increased by the examination of my own collection, which, however, has not been possible. The subfamily under the name of "Family Flatidae" has been monographed by Melichar (1902 Ann. Nat. Mus., Wien. XVI, 178-258 and XVII, 1-253, Pls. 1-9).

All the Australian forms have short antennae.

Neomelicharia Kirkaldy.

Neomelicharia Kirkaldy, 1903, Entom. XXXVI, 79.

Colgar Melichar, XVII, 107, (nec Kirkaldy).

A genus of insular forms, ranging from Java to Papua.

1. *furtiva* (Melichar).

? *Colgar furtiva* Mel. 115.

This applies fairly well to Melichar's description, except that it is a quarter smaller, and the middle heel of the mesonotum is obsolescent. The third segment of each of the tarsi is blackish, while the apical margin and apical third of the costal and commissural margins are smoky, the tibiae apically more or less so.

Length: 15¼ mill.

Hab: Queensland, Cairns (viii); Melichar records it from Papua.

2. ? *atomaria* (Walker).

This form, from Tasmania, is unknown to me.

Siphanta Stal.

Siphanta Stal, 1866, Hem. Afr. IV, 238; Melichar, 36.

Melichar has noted two species from Australia, Schmidt added one last year, and I have now added eight, but it is probable that there are more, even in the material I have examined, as the species appear to run very close. They are difficult to characterize, as the only differences seem to be small, but constant, points. Mr. Perkins tells me, however, that they are quite distinct in the field.

1. *galeata*, sp. nov. (Pl. XXXIII, fig. 11).

Distinguished from the other *Siphantas* by the narrow, elongate vertex, etc.

Bright green (fading to yellowish green partly or wholly), greenish testaceous beneath; apical margin of tegmina and anterior margin of vertex narrowly sanguineous. Vertex longer than pronotum, lateral margins roundly converging in a rounded acute angle. The eyes are much more prominent and the pronotum more prominent anterolaterally than in *S. acuta*. Tegmina very thickly set with small reddish brown granules, leaving one small, naked spot of varying extent in the middle of each reticulation. Reticulations very large; apical margin subtruncate obliquely, sutural angle acutely produced.

Length: 9-11 mill.

Hab: Queensland, Cairns (vii-viii), Nelson (vii).

2. *acuta* (Walker). (Pl. XXI, f. 2).

Poeciloptera acuta Walker, 1851, List. Hom., 448.
Siphanta acuta Melichar, 37, Pl. 3, fig. 13.

The sutural angle is more acute in some examples than in others. The vertex is usually roundly angulate, sometimes it is distinctly angulate. It is to be noted that in examination, the insect must be kept horizontal, as the further the head is tilted, the more angulate the vertex becomes to the view.

Hab: Queensland, Bundaberg (xi); New South Wales, Sydney (i-ii); introduced into the Hawaiian Islands. Melichar records it, possibly in error, from Tasmania also.

3. *acutipennis*, sp. nov.

Closely allied to *S. acuta*, but the reticulations are less granulate, and different in form; the sutural angle more acute. Vertex more elongate and more truncate anteriorly, lateral margins more parallel. Disk of wings immaculate, except that sometimes there are one or two tiny red specks.

Length: 10½ mill.

Hab: Queensland, Cairns (vi), Nelson (vii).

4. *breviceps*, sp. nov.

Allied to *S. acutipennis*, but the vertex is shorter than the pronotum (or at least not longer) and rounded anteriorly. Bright grass green, granules of corium rather closer and more numerous than in *S. acuta*.

Length: 8½ mill.

Hab: Queensland, Bundaberg (vi).

5. *toga*, sp .nov.

Probably of same general form as *S. patruelis* Stal,[*] but the vertex is longer and the pattern different. Grass green, paler beneath; a yellow longitudinal oblique stripe on the tegmina. Apex of vertex, tibiae more or less sanguineous.

Vertex and pronotum about the same length, the first named forming a right angle anteriorly. Tegmina about three-fourth longer than wide, subparallel after the basal fourth, apical angles rounded, not prominent.

Length: 9-9½ mill.

Hab: Queensland, Cairns (vii), Nelson (vii), Bundaberg (vi).

The yellowish stripe is sometimes more or less blended with the ground color of the tegmina. This species is strongly granulate all over head pronotum, scutellum, clavus, etc., with scattered ones on corium; the taller are reddish brown, those on the clavus blackish brown.

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[*] Stal states Manila as habitat of *patruelis*; Melichar, who seems to have examined the type, says 'Java'.

6. *lucindae*, sp. nov.

Size and form of *Sephena cinerea*; apparently close to *S. granulicollis* (Stal.) but larger and the color different; vertex anteriorly angulate. Orange yellow, paler beneath; head more or less suffused with sanguineous; commissure and apical margin sanguineous, the latter chequered with the ground color; tegminal granulations black.

Vertex anteriorly obtusangulate, scarcely extending beyond the eyes, nearly twice as broad as long. Corium (excluding the margins) with about fifteen granulations.

Length: 6 mill.

Hab: Queensland, Lucinda Point (vii).

7. *granulicollis* (Stal.)

Poeciloptera granulicollis Stal, 1859, Eugenies Resa, Ins. 282.

Siphanta granulicollis Melichar, 38.

Like *S. lucindae* but narrower, colored differently. With twice as many granulations on the corium (excluding the margins).

Length: 5½-6½; (Melichar says 5, Stal 4!)

Hab: Queensland, Cairns (viii).

Melichar records also from Sydney.

8. *subgranulosa*, sp. nov.

Closely allied to *S. granulicollis*, but granulations as in *S. lucindae*.

Length: 6½-8 mill.

Hab: Queensland, Cairns (vii).

9. *granulata*, sp. nov.

Close to *S. lucindae*, but differently colored, and granulated as in *S. granulicollis*.

Pale brownish cinereous; head, pronotum and scutellum more or less suffused with sanguineous or orange; commissure and apical margin of tegmina more or less sanguineous. Tegmina with a faint violet tinge; costa pallid.

Length: 6⅛ mill.

Hab: Queensland, Cairns (vii).

10. *rubra* Schmidt.

Siphanta rubra Schmidt, 1904, Stett. E. Zeit., 64, p. 358.

Hab: Queensland.

Unknown to me.

Euryphantia, gen. nov.

Vertex flat, laterally carinate, the keels extending fairly straight to a little above the eyes, then diverging, meeting apically in a rounded obtuse angle; with eyes narrower than the pronotum. Lateral margins of frons sinuate, widened out roundedly towards the apex with three internal carinae, the lateral two of these meeting (on a higher, as seen in profile, level than the exterolateral carinae) at the apex with the median carina in an acute angle, rounded exteriorly. Ocelli very distinct. Antennae very small, scarcely extending laterally to half the width of eye as seen from below. Clypeus not carinate. Vertex carinate medially, the keel extending through pronotum and mesonotum, the latter with sublateral keels which unite posteriorly, the median being obsolescent a trifle anterior to this. Pronotum granulate; tegmina elongate, subparallel, irregularly reticulate especially apically, apical margin obliquely subtruncate; apical angle rounded, extending a little further than the sutural angle. The cubital vein is the only one forked in the basal half of the tegmen, the forking taking place at about the basal third of the tegmen. There are a few veins in the clavus, but scarcely transverse. Costal cell about the same width throughout and open apically; thickly set with tiny granulations, as is also almost the whole of the tegmen, except the exterior claval area, and the two corial areas adjoining it. No regular subapical transverse line. Posterior tibiae with one spine.

1. *cinerascens*, sp. nov.

More or less cinereous, the mesonotum brownish. Tegmina subhyaline, pale cinereous, reticulations tinged with brownish. Granulations brownish. Ocelli red.

Length: 8¾ mill.

Hab: Queensland, Bundaberg (vi).

Sephena Melichar.

Sephena Mel., XVI, 197.
A genus of forms from Papua and neighboring islands.

1. *rubida*, sp. nov.

Vertex and frons dark purplish-brown, keels yellowish brown. Pronotum and scutellum yellowish brown, keels of the latter ferruginous. Tegmina pale rosy brown with mealy bloom, and some darker spots. Wings milky white, veins brownish black. Legs yellowish brown.

General form of *Paratella umbrimargo.*

Length: 7½ mill.

Hab: New South Wales, Sydney (i-ii).

Although this and the following have the characters of *Sephena* assigned by Melichar, they have more the appearance of *Paratella.*

2. *hyacintha*, sp. nov.

Blackish, keels of head yellowish brown. Tegmina opaque, bluish black; costa more or less dirty yellowish. Legs yellowish brown.

Length: 7-9 mill.

Hab: Queensland, Cairns (vii-viii), Brisbane (vi).

3. *cinerea*, sp. nov.

Smaller and narrower than *S. rubida*, vertex narrower. Pale brownish cinereous, immaculate. Eyes reddish.

Length: 6½ mill.

Hab: New South Wales, Sydney (i-ii).

4. *argus*, sp. nov.

Form and size of the preceding.

Head, pronotum and scutellum pitchy; keels of vertex ochraceous. Eyes reddish. Tegmina brownish with a faint violet tinge, spotted and granulate with violet brown.

Length: 7 mill.

Hab: Queensland, Cairns (viii).

Colgar Kirkaldy.

Colgar Kirkaldy, 1900, Entomologist. XXXIII 242.
Cromna Melichar, XVII, 59 (nec Walker).
A genus from Australia and the neighboring isles.

1. *peracuta* Melichar.

? *Cromna peracuta* Walker, 1858, List. Hom. Suppl., 120.
Cromna peracuta, Mel. 62.
Hab: Queensland, Bundaberg (vi), also recorded by Melichar from New South Wales and Aru Isle.

2. *frontalis* Melichar.

Cromna frontalis, Mel. 59.
Melichar records this from Queensland: Rockhampton (and Palmerston County—? Queensland or North South Australia).

Mimophantia Matsumura.

Mimophantia Mats., 1900, Ent. Nachr. XXVI, 212; Melichar, XVII, 17.
A single species has been described from Japan.

1. *australensis*, sp. nov.

A little smaller than *M. maritima*; the vertex is about one-half longer than pronotum, which is not so acute anterolaterally, and the points do not extend beyond the eyes laterally. Sutural angle not so acuminate. Sternites blackish brown; posterior margins pale.

Length: $4\frac{7}{8}$-5 mill.

Hab: Queensland, Cairns (vii-viii) on grass, Kuranda (viii), Bundaberg (ix-xii).

Aphanophantia, gen. nov.

In Melichar's tables, this runs down to *Gyaria* but differs by the frons being carinate, and not much longer than wide. Head and pronotum subporrect, not declivous as in *Gyaria*, vertex a little longer than pronotum, conical, rectangularly prominent anteriorly, truncate posteriorly. Pronotum roundly, widely emarginate posteriorly, scutellum with a double keel medianly and a lateral one each side. Pronotum and scutellum feebly carinate. Tegmina subcoriaceous, little longer than wide, posteriorly roundly obliquely truncate; reticulate; costal cell generally broader than sub-costal cell, with many simple transverse veins. Wings rudimentary.

1. *cuscuticida*, sp. nov.

Pale testaceous or pale cinereous, tegmina a little smudged in places sometimes, with pale sordid brownish; nerves whitish. Abdomen blackish brown, posterior margins of segments pallid.

Length: 2-2½ mill.

Hab: New South Wales, Sydney (ii) on *Cuscuta* grass.

Massila Walker.

Massila Walker 1862, Journ. Ent. I, 314.

Allied to *Anidora* Mel., but with differently formed tegmina, etc.

Vertex very short, transverse, apically subtruncate, scarcely extending beyond the eyes. Frons vertical, laterally rounded, medianly carinate, width and length about equal, lateral keels strongly elevated. Clypeus set somewhat deeply into the frons, medianly carinate. Antennae very short. Ocelli distinct. Pronotum simple, wider than head and eyes, anteriorly truncate in the middle, posterior margin roundly excavate. Mesonotum longer than head and pronotum together. Tegmina elongate, more than twice as long as broad, irregularly reticulate; interior margin of clavus strongly arched, basal ⅔ of costal margin arched, the apical third straight and subparallel with opposite margin of tegmina, apical margin subtruncate; no subapical line. Costal cell narrow. Posterior tibiae with one spine. Type *sicca* Walker.

There are two species very closely allied.

1. Cubital clearly forked near the middle, subradial also clearly forked a little nearer the apex..........*sidnica*, sp. nov.

1a. Subradial indistinctly forked...........*walkeri*, sp. nov.

1. *walkeri*, sp. nov.

Agrees fairly well with the description of *M. sicca*, except that the transverse veins in the tegmina, specks in the reticulations, claval granules (at least in part) are pale sanguineous; this is so conspicuous that Walker could hardly have had this species before him when describing *sicca*, unless he had alcoholic material.

Length: 7 mill.

Hab: Queensland, Brisbane (vi), Bundaberg (ix-xii).

2. *sidnica*, sp. nov.

Very close to the last but smaller and more reticulate. The characters in the key also seem to distinguish it.

Length: 6 mill.

Hab: New South Wales, Sydney (i-ii).

Of the two species previously described, *M. sicca* has already been referred to. *M. unicolor* Walker (1862 Journ. Ent. 1, 315) does not seem to belong to the genus.

Jamella, gen. nov.

Belongs to the Phalaenomorphini, but does not seem to be closely related to any other genus.

Vertex short, three to four times as wide as long, subtruncate anteriorly, carinate medianly. Eyes prominent. Frons a little longer than wide, at about right angles to the declivous pronotum, basal half carinate medianly. Second segment of antennae much wider apically than basally, obliquely truncate apically. Pronotum anteriorly truncate, narrower there than the vertex, anterior margin almost on a line with the anterior margin of the eyes, lateral margins highly sinuate, posterior margin subrotundately emarginate, somewhat obsolescently tricarinate. Scutellum with three keels, the lateral ones sinuate. Tegmina subhorizantal, overlapping apically. Costa a little arched near the base, costal rather wider than sub-costal cell; radial vein forked near the base, cubital forked a little nearer the apex; no subapical line. Tibiae with one spine.

1. *australiae*, sp. nov.

Testaceous; tegmina pale cinereo-testaceous, veins, cross-veins and tiny specks in many of the cells pale brownish, sometimes with a reddish tinge.

Length: 9-9½ mill.

Hab: Queensland, Cairns (viii).

The following have also been recorded from Australia and Viti:

Aflata Mel.

1. *stali* Mel. p. 8, Pl. VII, fig. 3. *S. Australia.*

Microflata Mel.

1. *stictica* Mel. 10 Pl. V, fig. 2.

Euphanta Mel.

1. *acuminata* Mel. 39 *Viti*, Ovalau.
2. *ruficeps* Mel. 39.
3. *munda* (Walker) Mel. 39 *S. Australia.*
4. *luridicosta* Schmidt 1904 Stett. Ent. Zeit., 359. *Queensland.*
5. *rubromarginata* Schmidt, op. c., 360.

Paratella Mel.

1. *nivosa* (Walker) Mel. 121. *Queensland.*
2. *fusconigra* Mel. 121 "
3. *fumaria* Mel 122. *New South Wales.*
4. *modesta* Mel. 122. *Queensland.* (Also from New Zealand, probably a mistake.)

Dascalina Mel.

1. *aegrota* Mel. 155, Pl. VII, fig. 6. *Queensland.*
2. *reversa* Mel. 155, fig. 15. "
3. *alternans* Mel. 155, fig. 15. "
4. *contorta* Mel. 156, Pl. IX, fig. 8. "

Addendum.

The original manuscript containing the descriptions of the following forms having been lost, and therefore omitted in the proper place, these are now added:

Fam. Tetigoniidae.
Subfamily Iassinae.
Tribe *Cephalelini.*

Myrmecophryne, gen. nov.

This should probably be placed near *Graphocraerus*, Thompson; it has somewhat the appearance of *Xestocephalus*, Van Duzee.

Oval. Vertex transverse, declivous; rounded in front, as viewed dorsally (eyes forming part of the curve), but actually slightly emarginate. Frons short, laterally rounded, very declivous to vertex, slightly convex. Clypeus little longer than broad, parallel-sided; genae rather long. Pronotum transverse, lateral margins rather short, not carinate. Posterior tibiae flattened, rather elongate. Tegmina broad, laterally rounded, venation rather obscure, apparently not unlike that of *Graphocraerus*; wings like *Graphocraerus*.

1. *formiceticola*, sp. nov.

Piceous; vertex with a short longitudinal line on each side close to the middle, a short transverse line nearer the lateral margins, about 3 specks near the anterior margin, testaceous. Pronotum with about 12 specks and scutellum with 4, testaceous. Tegmina subopaque piceous, with brownish testaceous subhyaline spots. Abdomen piceous, legs sordid testaceous.

Male: Frons sordid testaceous.

Female: Frons piceous variegated with testaceous.

Length: (male) 2; (female) 2¼ mill.

Hab: Queensland, Bundaberg, Sandhills, in an ant's nest (x).

Subfamily *Penthimiinae*.

This subfamily (Gyponidae or Scaridae of some authors) is usually considered to be closely allied to the Tetigoniinae, but I suspect that this view is due mainly to the ocelli being dorsal.

Thaumatoscopus, gen. nov.

Allied to *Gypona* Germar; somewhat of the form of *Ledropsis*, but more fragile, and shorter. Head a trifle narrower than the anterior margin of pronotum; vertex transverse, foliaceous, produced well in front of eyes, very thin in profile. Ocelli small, discal, situated just above the imaginary line joining anterior margin of eyes. Pronotum transverse, lightly transversely striate, middle three-fifths of anterior margin truncate, posterior margin only a slightly sinuate. Scutellum transverse, lightly transversely striate.

1. *galeatus*, sp. nov. (Pl. XXX, fig. 8.)

Luteotestaceous; foliaceous part of frons orangered; the rest, as well as the basal two-thirds of genae and the base of clypeus and of lorae, black; rest of face, the rostrum, anterior and intermediate legs, testaceous. Prosternum and 4 spots on the apical margin of the scutellum, black. Tegmina pale luteotestaceous, more or less hyaline, veins opaque, pale luteous. Wings dark smoky. Abdomen yellowish, more or less suffused discally with brownish, sparingly marked with black. Posterior femora and tibiae mostly black.

Vertex and venation figured.

Female: Last segment transverse, apically bisinuate, the short median prolongation very minutely notched.

Length: 7 mill., breadth $2\frac{3}{4}$ mill.

Hab: Queensland, Cairns (viii).

Vulturnus, gen. nov.

Closely allied to *Thaumatoscopus*, but head only slightly foliaceous anteriorly; cells of tegmina irrorate. Type *vulturnus*.

1. *vulturnus*, sp. nov.

Pale orange, somewhat sordid, the pronotum somewhat suffused with olivaceous. Scutellum with anterior angles and a short slender median transverse line, olivaceous. Foliaceous part of vertex, a spot on the disk and the lateral margins, of the genae, etc., orange; rest of sterna, sternites, etc., testaceous. Tegmina subhyaline costally, milky subopaque inwardly, veins brown and yellowish, cubital area with many short transverse veins, inner discoidal and the two inner subapicals closely irrorate; clavus irrorate. Wings dark smoky. Vertex similar in shape to *Thaumatoscopus*, but shorter.

Female: Last segment transverse, bisinuate, slightly produced obtusely in the middle, last sternopleural segment toothed intero-laterally near the base. Ovipositor black.

Length: $4\frac{1}{2}$ mill.

Hab: Queensland, Cairns (viii).

Ectopiocephalus, gen. nov.

This remarkable genus is readily distinguished by the exceedingly declivous pronotum, and the structure of the vertical head. It is Cercopoid in appearance. Vertex apical, slightly convex, transverse, head dorsally anteriorly with (what is probably) a large part of the frons visible, forming a suboval plate in the same plane as the vertex. Ocelli immediately basal of this, much nearer the eyes than to one another. Frons excavate as in the other genera, but the head not at all foliaceous. Pronotum roundly declivous, anterior margin rounded in front, posterior margin roundly emarginate medianly. Tegminal venation obscure, subreticulate; with an appendix.

1. *vanduzeei*, sp. nov. (Pl. XXX, figs. 6-7.)

Bluish black; vertex, pronotum and scutellum polished; beneath dull black. The whole surface more or less covered with red powder, doubtless similar to the white flocculence of the Fulgoroidea. The dorsal part of the frons, eyes, and small false-ocellar spots on vertex, etc., are certainly red, and possibly other parts, but it is impracticable (in the unique type) to determine what is colour, what powder.

Length: $6\frac{3}{4}$ mill.

Hab: Queensland, Bundaberg (xi).

Subfamily Agalliinae.

Ipo, gen. nov.

Distinguished from *Idiocerus* by the quite different ventaion, especially the constitution of the discoidal cells and the presence of 5 apicals; there are also transverse veinlets towards the apex of the subcostal (marginal) cell, and there are 2 transverse veins standing on the cubital. The antennal ridges also extend only about one-half of the distance from frons to eye, and are shallow.

Very little of the vertex can be seen dorsally, and the eyes are prominent, not forming part of the curve of the head; the apical margin of the vertex is ventral and is emarginate roundly, to admit the base of the diamond-shaped frons; ocelli placed a little laterally, right against the frons, close to the apical margin of the vertex. Frons with a very slight, ovate swelling in the center, from base to apex. Clypeus oblong, longer than wide, lorae rhomboid, about as wide or a little wider, each, than clypeus, slightly rounded posteriorly exterolaterally. Rostrum about twice as long as clypeus. Antennae socketted on a level with the posterior margin of the eyes, simple in both sexes. Vertex and pronotum transversely, finely, but a little irregularly, aciculate-punctate. Head and eyes distinctly wider than pronotum, the latter transverse, roundly declivous anteriorly, lateral margins obsolescent, anterior and posterior margins meeting acutely. Costal margin arched; clavus punctured. Membrane with an appendix. Wings with supernumerary cell. Posterior tibiae deeply grooved, with a row of about 7 strong setiferous spines. Type *ambita*.

1. *ambita*, sp. nov.

Head and pronotum pale testaceous, the vertex and pronotum strongly clouded with blackish brown, without definite spots. Scutellum pale castaneous. Underside and the tergites pallid, pleural region more or less crimson. Tibaei, tarsi and apical parts of femora more or less blackish brown. Tegmina hyaline, basal fourth clouded with black, two narrow transverse stripes and apex of corium blackish-brown.

Male: Valve in profile elongate, rounded apically. Frons clouded also with black. Clypeus black.

Female: Last abdominal segment more or less straight medianly; valve long, depressed in a wedge shaped manner at the base.

Length: (male) 7½; (female) 9½ mill; breadth across eyes 4¼-5 mill.

Hab: Queensland (one male in my collection), Bundaberg (3 females).

2. *conferta*, sp. nov. (Pl. XXII, figs. 10-11).

Smaller than the type, tegmina not narrowed so suddenly apically, and the interior subapical cell very short. Pleural region not reddish. Frons, clypeus, etc., concolorous, pallid in both sexes; a narrow longitudinal pale line on head and pronotum. Tegmina dark, mottled with whitish, with a broad undulating discolorous band from nearly the middle of the subcosta to lateral margins of scutellum; exteroapical third hyaline, veins black. Scutellum with anterolateral angles broadly dark.

Male and female: Valve rounder and shorter than in *I. ambita*.

Length: 6¼ mill.

Hab: Queensland (my collection), Brisbane (xi), Bundaberg (ix-xii), Koebele's No. 2300.

The nymph has spineless legs.

3. *honiala*, sp. nov.

Smaller than *I. conferta*; the head and eyes only slightly wider than pronotum; tegmina narrow and not so rounded subcostally, venation more irregular. Frons, etc., pallid, median part of the former clouded with blackish brown, lorae and clypeus each with a dark median mark, and the genae smudged with black. Tegmina brownish hyaline, more or less colourless apically; there is a curved whitish fascia on the basal half from basal angle to nearly half the length of the subcosta, the curve not nearly touching the length of the subcosta, the curve not nearly touching the commissure; veins partly whitish. Lorae each about twice as wide as the clypeus and well rounded exterolaterally. Genital segments on the plan of *I. conferta*.

Length: $5\frac{1}{2}$-$5\frac{3}{4}$ mill.

Hab: Queensland, Brisbane (vi).

4. *aegrota*, sp. nov.

About the same size as *I. honiala*, but the eyes are larger and more prominent, especially laterally; tegmina more narrowed apically; lorae not so rounded exteriorly, little wider than the clypeus.

Pale testaceous; vertex, pronotum and scutlelum more or less clouded with brownish, no definite markings. Tegmina hyaline, more or less tinged with yellowish, more or less obscurely clouded with brownish and with an ill-defined whitish fascia near the base.

Length: 6 mill.

Hab: Queensland, Cairns (viii).

Idiocerus, Lewis.

Idiocerus Lewis 1835 T. E. S. London, I, 47, Pl. VIII, fig. 2. Van Duzee 1894 T. Amer. E. S. XXI, 260; Edwards 1896 Hem. Hom. Brit. Isl., 97, Pl. I, f. 31, Pl. XXI and XIII, figs. 1-6; Pl. XXIX, f. 1; Osborn & Ball 1889 P. Davenport A. N. S. VII, 124-38, Pl. III.

Bythoscopus subg. *Idiocerus* Burm. (1838?) Gen. Ins. Bythoscopus, figs. 5, 6.

1. *ipo*, sp. nov.

About the size and form of *I. nigroclypeatus*, Mel.

Bright greenish or greenish yellow, immaculate. Pronotum (except lateral margins), scutellum, axillary cell of clavus, commissure, etc., crimson. Eyes black. Tegmina hyaline, tinged with grenish basally and exteriorly; veins greenish. Pleural region, etc., pale yellowish. Clypeus broad, fairly parallel-sided.

Female: Last segment very obtusangularly emarginate, valve pale yellowish, transverse, apically truncate, sides rounded. Ovipositor crimson.

Length: $4\frac{1}{8}$ mill.

Hab: Queensland, Brisbane (vi).

The following are species of Tetigoniidae described from Australia, but unrecognizable by their descriptions:

1. *Coelidia australis* Walker 1851 List. 856, referred to *Bythoscopus* auct. by Stal.
2. *Bythoscopus rivularis* Walker op. c., 865=*dorsalis* Walker op. c., 867=*repletus* Walker 1858 Suppl. 267.
3. *B. fulvus* Walker 1851 List. 866=*latifrons* 869.
4. *B. anguliferus* Walker, op. c., 868.
5. *B. transversus* Walker, op. c., 869.
6. *B. luridus* Walker, op. c., 870.
7. *B. cupreus*, Walker, op. c., 871.
8. *B. australis*, Walker, op. c., 872.
9. *B. obliquus* Walker, 1858 Suppl., 267.
10. *B. abscondens*, Walker, l. c.
11. *B. punctivena*, Walker 1858 Ins. Saund. Hom. 104.
12. *B. multistriga*, Walker, op. c., 105.
13. *B. signifrons*, Walker, op. c., 106.
14. *B. testaceus*, Walker 1852 List. 1163.
15. *Scaris australis*, Walker 1858 Suppl. 267.
16. *Iassus detractus*, Walker, op. c., 271.
17. *Gypona nigra*, Walker 1862, J. Ent., I, 319.
18. *Trocnada dorsigera*, Walker 1858 Ins. Saund. Hom. 104.
19. *Albelterus incarnatus*, Stal 1865 O. V. A. F., XXII, 158.
20. *Rubria* (*Petalocephala*) *sanguinea* Stal. l. c.
21. *R. carnosa*, Stal, op. c., 159.
22. *Macroceps fasciatus*, Signoret 1880 A. S. E. France (5) X, 364. Pl. 10, f. 89.
23. *Ledromorpha vaginata*, Stal 1864 op. c., (4), IV, 68.
24. *L. planirostris* (Don.)—sec. Stal. (This has been previously referred to under "*Ledra*").
25. *Ledropsis coccinea*, Butler 1874 P. Zool. S., London, 673.

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Perkinsiella saccharicida, gen. et sp. nov.

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See also Sahlberg, 1871, Osborn & Bull, 1897, etc.

Description of Plates.

Plate XXI.

1. Tegmen of *Scolypopa australis.*
2. The same of *Siphanta acuta.*
3. The same of *Philadelpheia pandani.*
4. The same of *Lamenia kulia.*

Plate XXII.

1. *Phrynophyes parvula*, female.
2. The same in profile.
3. Face of the same.
4. *Giffardia dolichocephala*, female.
5. Face of the same.
6. *Macroceratogonia aurea*, female.
7. Face of the same.
8. *Anemochrea mitis*, female.
9. Face of the same.
10. *Ipo conferta.*
11. Face of the same.
12. *Ancono pulcherrima.*

Plate XXIII.

1. *Tetigonia parthaon.*
2. Face of same.
3. Nymph of same.
4. *Epipsychidion epipyropis.*
5. Face of same.
6. Nymph of same.
7. *Kosmiopelex varicolor.*
8. Face of same.
9. *Thaumatoscopus galeatus.*
10. Face of same.
11. Head of same in profile.

12. *Polychactophyes serpulidia*, nymph skin in profile.
13. "Operculum" of the same.

Plate XXIV.

1. *Rhotidus flavomaculatus*, female.
2. Face of the same.
3. Nymph of the same.
4. Face of the same.
5. *Cephalelus brunneus.*
6. Face of the same.
7. *Phrynophyes phrynophyes*, female.
8. Face of the same.
9. *Tartessus syrtidis*, face.
10. Nymph of unknown membracid.
11. Nymph of another unknown membracid.
12. Face of same.

Plate XXV.

1. *Kyphocotis tessellata.*
2. The same in profile.
3. *Stenocotis planiuscula*, female.
4. Female of probably the same species.
5. Nymph of probably the same species.
6. Face of No. 3.
7. Apical sternites of the same.
8. The same of No. 4 in profile.

Pl. XXVI.

1. Ova of *Perkinsiella saccharicida* in situ, those at the sides being shown somewhat in profile and in section.
2. The same isolated.
3. *Perkinsiella saccharicida*, nymph of first instar.
4. The same, second instar.
5. The same, third instar.
6. The same, fourth instar.
7. Face of the same.
8. Adult female of same, brachypterous form.

Pl. XXVII.

1. Adult male of *Perkinsiella saccharicida.*
2. Face of same.
3. Genital segments of same.
4. Adult female of same, macropterous form.
5. Genital segments of same.
6. Nymph of *Vanua vitiensis.*
7. Face of same.
8. Nymphcase of *Pectinariophyes pectinaria.*
9. The same of *Polychaetophyes serpulidia.*

Pl. XXVIII.

1. *Phantasmatocera vitiensis*, head, etc.
2. The same in profile.
3. Tegmen of the same.
4. *Sardis maculosa*, head, etc.
5. Face of the same.
6. Tegmen of the same.
7. *Vanua vitiensis*, head, etc.
8. Face of same.
9. Tegmen of same.
10. *Astorga saccharicida*, head, etc.
11. The same in profile.
12. Face of the same.
13. Tegmen of the same.

Plate XXIX.

1. *Gelastissus albolineatus.*
2. Head of same in profile.
3. *Phaconeura froggatti.*
4. Face of same.
5. *Dardus abbreviatus*; nymph.
6. *Thyrocephalus leucopterus*, head and nota.
7. Face of same.
8. *Philadelpheia pandani*, head and nota.
9. Face of same.
10. *Thanatodictya hebe.*
11. Nymph of an allied form.

Pl. XXX.

1. *Tetigonia pasiphae,* vertex.
2. *Gelastorrhachis diadema,* pronotum from in front.
3. The same in profile.
4. *G. clavata,* pronotum from in front.
5. The same in profile.
6. *Ectopiocephalus vanduzeei,* vertex.
7. Head of the same in profile.
8. *Thaumatoscopus galeatus,* head, etc.
9. *Polychaetophyes serpulidia,* head, etc., in profile (slightly tilted).
10. *Swezeyia lyricen,* head, etc., in profile.

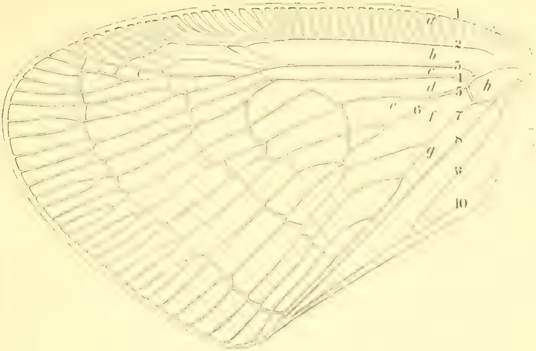
Plate XXXI.

1. *Thaumatoscapus galeatus,* tegmen.
2. *Aneono pulcherrima,* the same, (only the veins that are certainly visible are portrayed).
3. The same, more or less restored; the venation is so obscure in parts that it is difficult to determine it correctly.
4. *Issus ridicularius,* tegmen.
5. *Rhotidus monstrum,* the same.
6. *Eupteryx haematoptilus,* the same.
7. *Nesosteles hebe,* the same.
8. *Rhotidus ingens,* vertex.
9. *R. informis,* the same.
10. *R. monstrum,* the same.
11. *R. ledropsiformis,* the same.
12. *R. viridescens,* the same.
13. *R. horrendus,* the same.

Plate XXXII.

1. Wing of a Tetigoniine.
2. The same of an Eupterygine. N. B. '10' is really the submarginal, the wing having undergone degeneration apically.
3. Wing of an Agalliine.
4. The same of an Asiracid.

5. Claval and corial membranous appendages in *Polychaetophyes serpulidia.*
6. *Gelastocephalus ornithoides*, head and nota.
7. The same in profile.
8. *Nesosteles hebe*, head and pronotum.
9. *N. sanguinescens*, the same.
10. *Pettya anemolua*, the same.
11. *Siphanta galeata*, the same.
12. *Dryadomorpha pallida*, the same.
13. The same in profile.
14. The same in profile, dorsally tilted.
(In 12-17, *a*=sensory pit, *b*=ocellus).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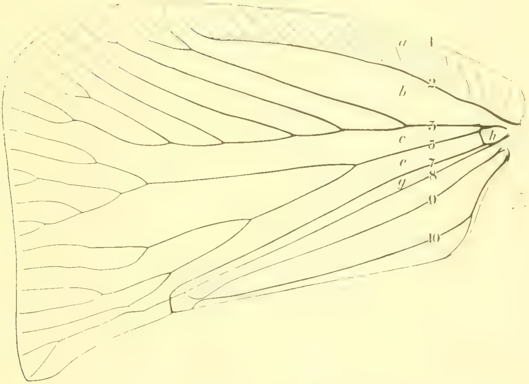
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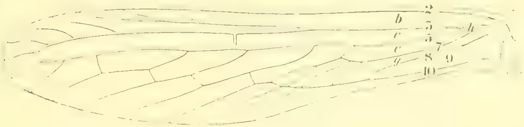
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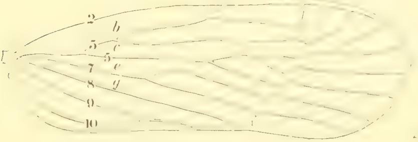
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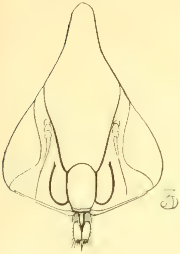
PLATE XXI.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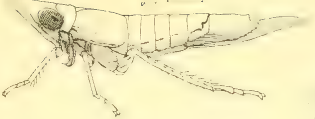
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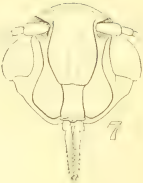
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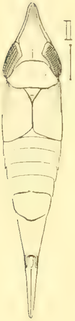
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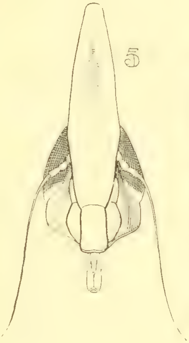
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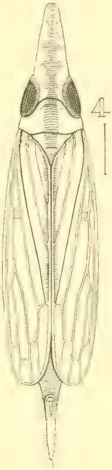
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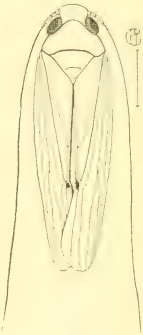
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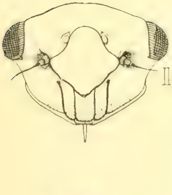
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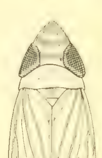
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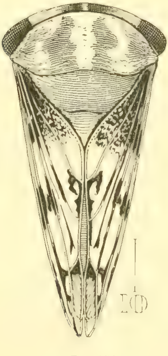
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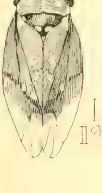
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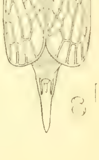
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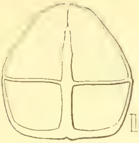
PLATE XXII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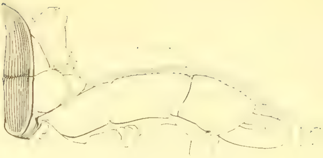
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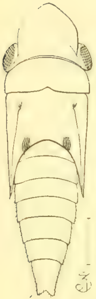
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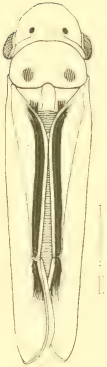
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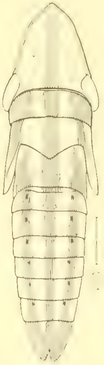
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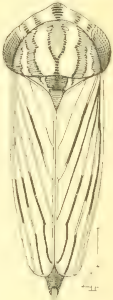
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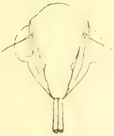

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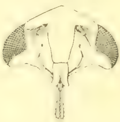

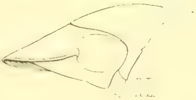
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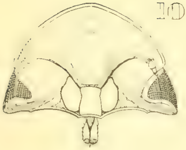
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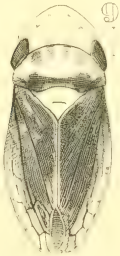
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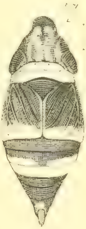
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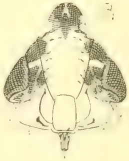
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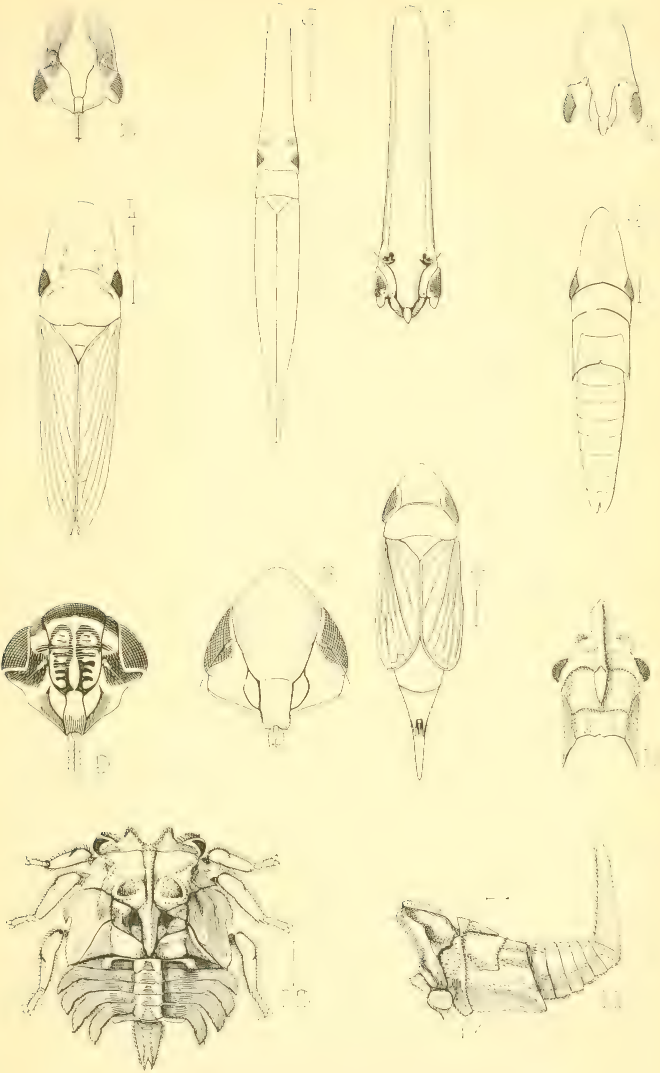

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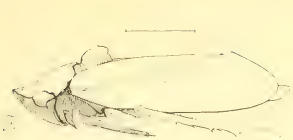

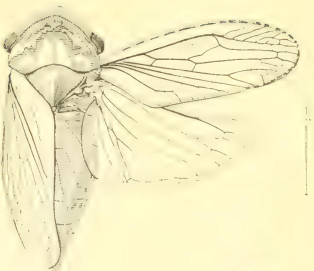

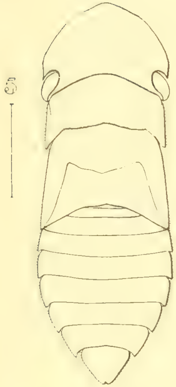

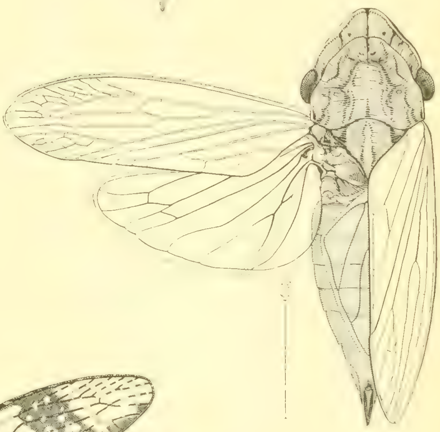

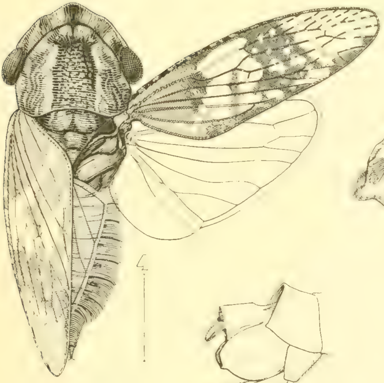

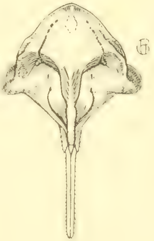

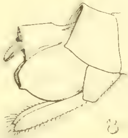

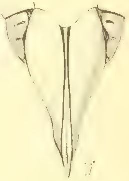

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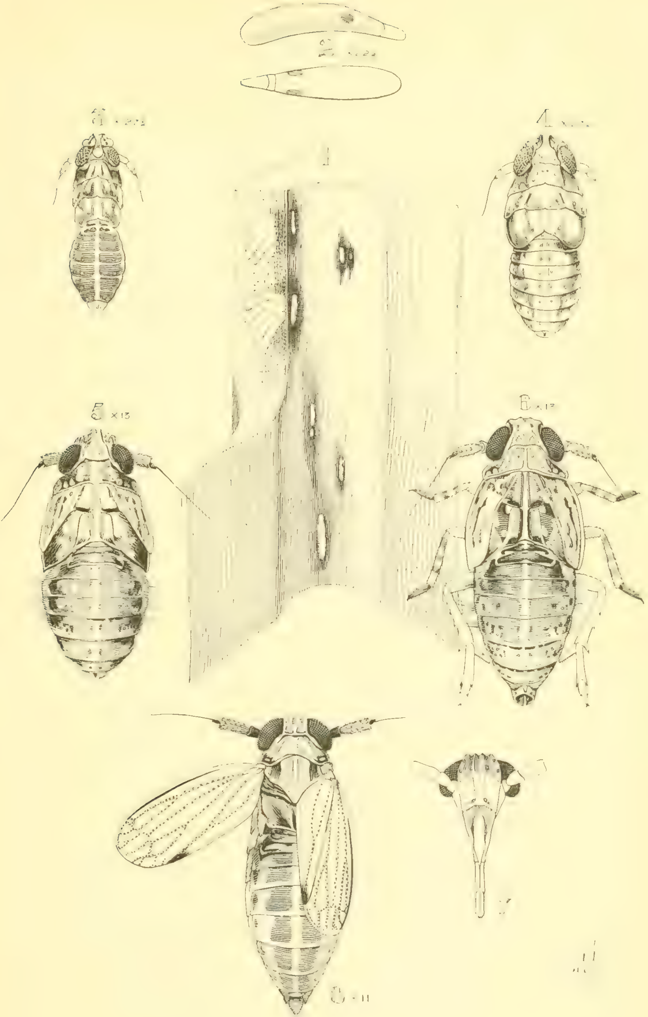
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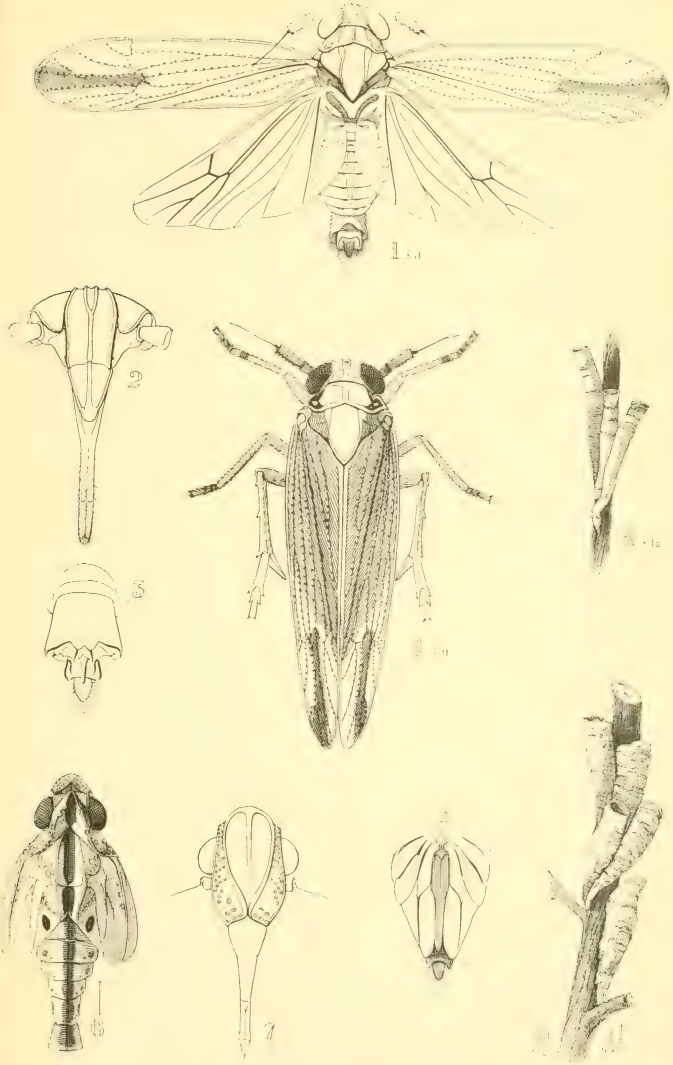

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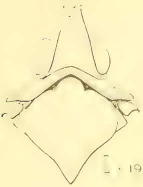

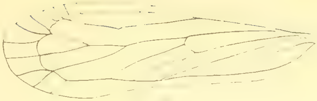

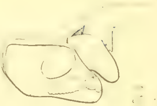

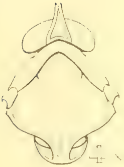

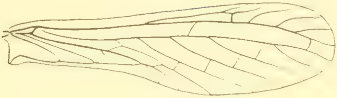

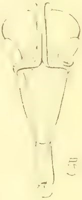

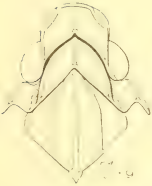

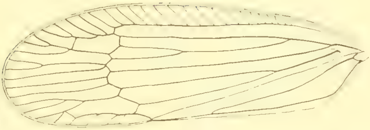

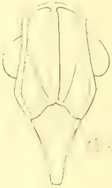

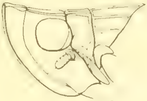

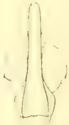

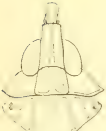

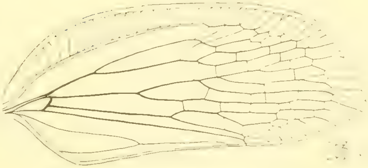

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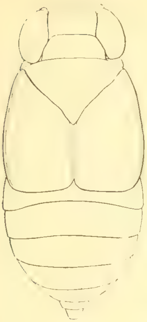

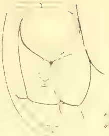

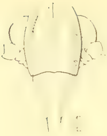

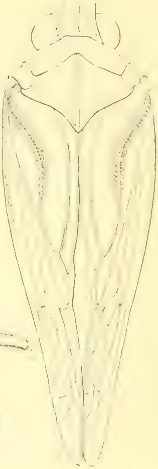

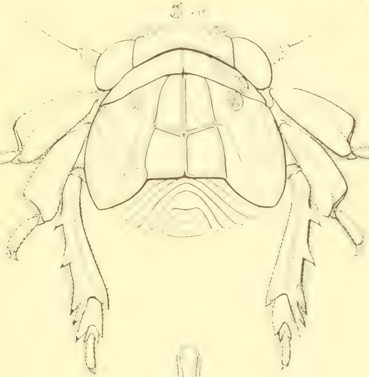

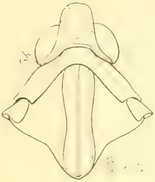

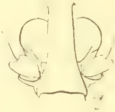

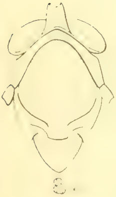

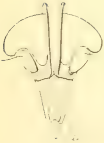

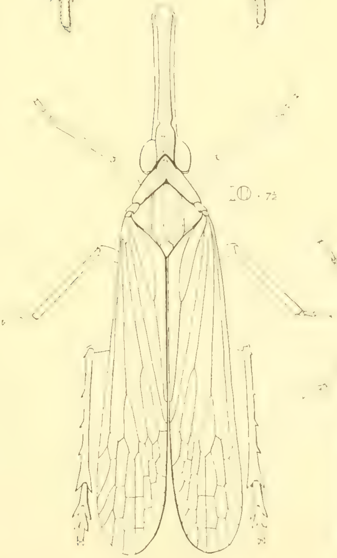

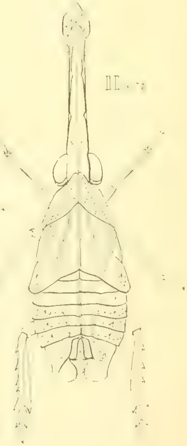

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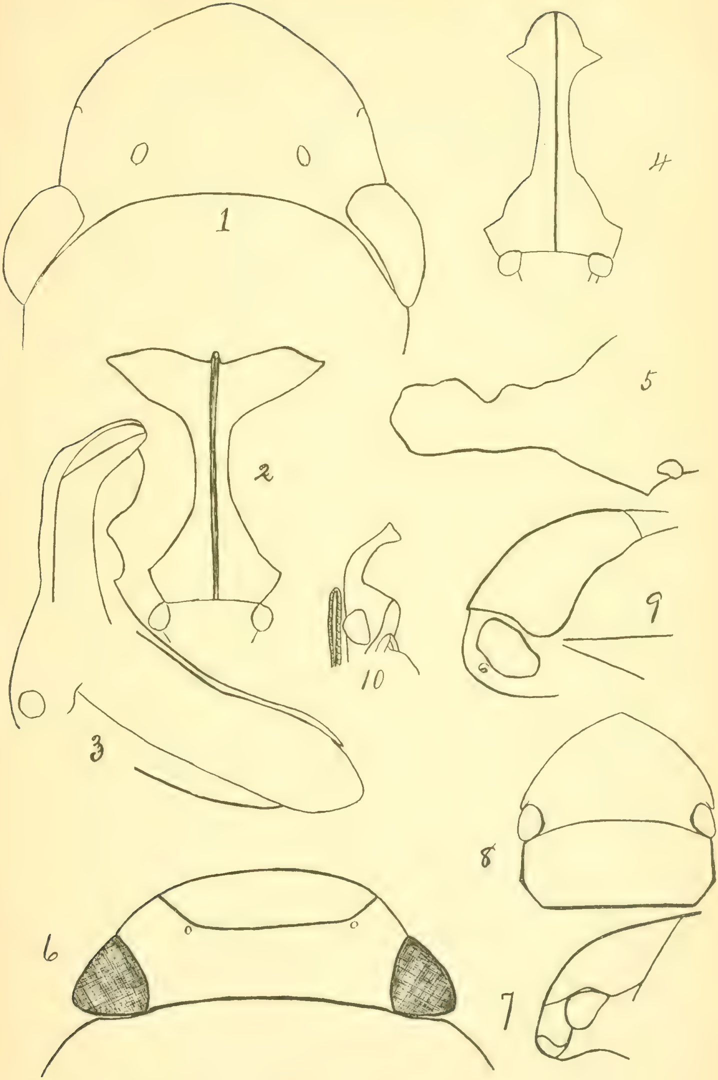
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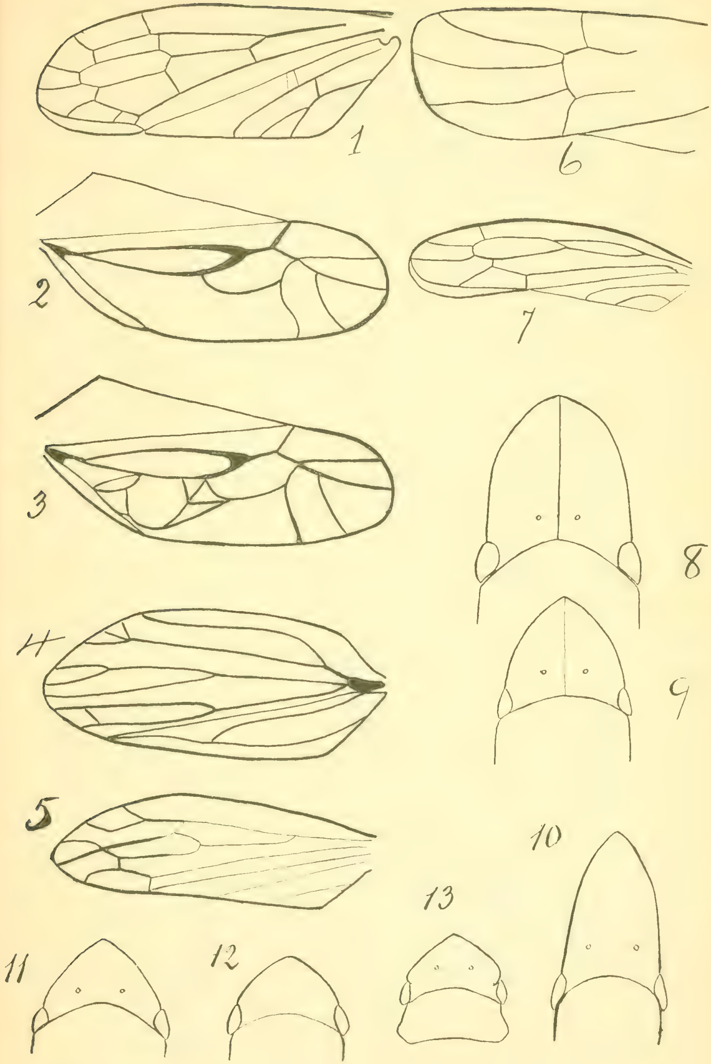
Kirkaldy del.

PLATE XXX.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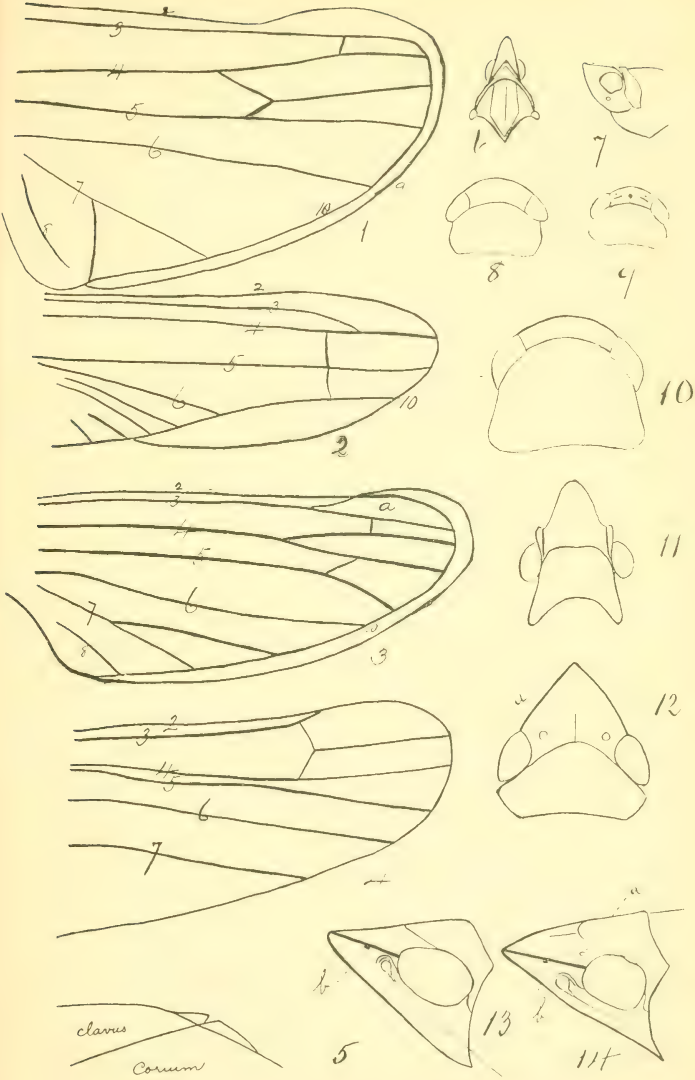
Kirkaldy del.

PLATE XXXI.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7
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2
3
4
5
6
7
4
clavus
Corium
5
6
7
8
9
10
11
a
12
b
13
a
b
14

Kirkaldy del

PLATE XXXII.

DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
PART 10

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. X. DRYINIDAE, PIPUNCULIDAE)

Supplementary

BY R. C. L. PERKINS

HONOLULU, H. T.
MARCH 1, 1906

HAWAIIAN SUGAR PLANTERS' ASSOCIATION

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DIVISION OF ENTOMOLOGY

BULLETIN NO. 1
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Supplementary

BY R. C. L. PERKINS

HONOLULU, H. T.
MARCH, 1906

LETTER OF TRANSMITTAL.

Honolulu, T. H., January 17th, 1906.

To the Committee on Experiment Station, H. S. P. A., Honolulu, T. H.

Gentlemen:—I herewith submit for publication the tenth part of the Bulletin on "Leaf-Hoppers and Their Natural Enemies," which is chiefly supplementary to the first part, and deals with observations made and material collected by Mr. Koebele in Australia and Fiji. This material was not available until the first part of the Bulletin had already been completed.

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

INTRODUCTORY REMARKS.

In Part I of this bulletin I detailed the habits of some Dryinidae, and described a large number of species, obtained partly as the results of Mr. Koebele's investigations in N. America, and more especially, through our researches in Queensland, from June to December, 1904. I now have to record the additional material that Mr. Koebele secured after my return to Honolulu, when he was continuing his researches for a few months in New South Wales and Fiji. In my introductory remarks on the Dryinidae I was only able to merely mention a recent paper by Dr. J. J. Kieffer on these insects, but as this paper throws light on some obscure points, and corrects several errors of older observers, I shall allude to these matters below, as well as making corrections of some clerical errors in my former paper. I also add a full description of that very distinct parasitic fly *Pipunculus cutrichodes*. In Part IV of this bulletin this species was omitted in the list of species on p. 131, and no detailed description was given subsequently, but both sexes were merely briefly characterized in the "Synopsis of Species" on p. 133 and 135.

As the first part of this bulletin dealing with the chief part of our material, was altogether without figures, I have now made drawings of many of the important structures therein described.

GENERAL REMARKS.

The number of new species of Dryinidae obtained in New South Wales and Fiji was not large, four from the former State, and the same number from the islands; in addition to which I describe two new species from Queensland. It should be mentioned that of the species already described from Bundaberg, Queensland, which is well outside the tropics, several were afterwards found by Mr. Koebele at Sydney, such species as *Paradryinus koebelei* and *Neodryinus raptor* being common there. At Sydney both of these frequently attack Fulgorids of much smaller size than those which are found infested at Bundaberg. Consequently the Sydney specimens are of very small size as compared with the Queensland examples, but do not otherwise noticeably differ.

I have referred to the facts that a *Gonatopus* is said to have been bred from the beetle *Ptinus fur*, a statement so remarkable, as to need verification. Dr. Kieffer in the paper I have cited tells us that this so-called *Gonatopus* probably belongs to the genus *Cephalonomia* of the Bethylidae. He also states that the genus *Mystrophorus* has chelate tarsi in the female, Foerster having mistaken his specimens for this sex, when really they were males. In my synopsis of genera in Pt. 1, p. 33 of this Bulletin *Mystrophorus* will therefore have to be removed from the neighborhood of *Anteon*, which will remain as the sole representative of that section of Dryinidae, of which the species have simple front legs in both sexes.

I have still left undescribed the greater number of male Dryinidae obtained by us. It might be supposed that as nearly all our male specimens were bred, there would be no difficulty in determining the species to which these belong. This, however, is by no means the case, for most of the graminivorous Delphacids and Jassids, from which these parasites are obtained, are liable to be attacked by two or three different species, and as males and females of the parasites are not reared from a single individual hopper, but only one or other sex, the difficulty of pairing the sexes is hardly lessened by the fact that the specimens are bred. The matter is really quite complicated, for a Dryinid sometimes attacks many species of leaf-hoppers, and a given leaf-hopper may be attacked by a number of distinct species of these parasites, even when all are collected in the self-same locality. Occasionally even an individual hopper is attacked by two, or even three, species of Dryinid parasites, these usually belonging to at least two genera. It is quite common also to obtain Stylopid and Dryinid parasites from a single specimen of the host, and *Pipunculus* is sometimes associated with one or other of these, but usually with the latter.

Nearly all these difficult males belong to what was once called the genus *Labeo*. Ashmead shrewdly conjectured that *Labeo* was the male of *Gonatopus*, (*sensu lat.*) a conjecture partially correct. In *Labeo*, however, he included male *Dryinus*, as well as *Gonatopus*, although the latter are at once distinguished by their short maxillary palpi, etc., etc. As colonies of *Gonatopus* and its allies can easily be raised in confinement, there is no doubt but that the sexes will ultimately be correctly associated and the generic characters of the males properly established. In my opinion the structure of the palpi, the condition of the parapsides of the mesonotum, and the antennal joints, will be of most use for this purpose. Such, however, is rather the work of a resident entomologist than of those on a temporary mission, and I do not feel disposed to create a number of new species on males of so-called *Labeo*, when many of these would ultimately fall as synonymous with species that I have already described from the other sex.

Additional material received from Koebele has shown no exception to the general rule that a species of Dryinid does not attack Fulgorid and Jassid indiscriminately. *Labeo typhlocybae* remains a most peculiar exception*, especially as the female (described originally as *Dryinus ormenidis*) of this species, of which I received some two thousand cocoons, is apparently attached only to certain species of one special group of the Fulgoridae. In my former paper I have remarked that the comparatively primitive forms of Dryinidae, having the stigma large and ovate, attack Jassids only. I have now met with a single exception to this rule. At Sydney on January 23rd, 1905, Koebele found an adult male of the Fulgorid, *Gaetulia chrysopoides*, a species frequently attacked in its nymphal condition by species of *Neodryinus* and *Paradryinus*, bearing beneath the body at the insertion of the hind coxae, the black sac of a Dryinid. The sculpture of the sac itself and likewise its position is so similar to that of *Neochelogynus* that I can hardly doubt that it belongs to this or some allied genus. Unfortunately the mature parasite was not bred.

I may say that the new species here described from Fiji and New South Wales, the fauna in each case being largely distinct from that of Queensland, fall admirably into the genera previously characterized by me. I have some doubts as to the value of my genus *Neodryinus*, as, having obtained Latreille's description of *Dryinus*, I find that this gives 3 joints to the labial palpi like the former, and four teeth to the mandibles. *Dryinus*, however, as interpreted by various hymenopterists, is, in my opinion, a composite genus, and I can not include such forms as *Dryinus americanus* Ashm. and the European *D. tarraconensis* Marshall, which have distinct and parallel parapsidal furrows, in the same genus as *D. ormenidis*, Ashm. and my several species of *Neodryinus*, which are without such furrows, because I attach the highest importance to the condition of the parapsides in the classification of the Dryinidae.

As most of the figures that I have drawn refer to Pt. I of this Bulletin rather than to the present, and necessarily no reference to figures was given in that part, I have given the description of the plates at considerable length, when necessary.

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* I have now reason to believe that this is not a true exception, on which matter see my remarks under *Dryinus* below.

SYSTEMATIC.

LIST OF GENERA AND SPECIES HERE DESCRIBED OR DISCUSSED.

The species marked with an asterisk have had the mouthparts dissected out and mounted in balsam or glycerine.

DRYINIDAE.

Pseudogonatopus.
  * *P. melanacrias*, sp. nov.
  * *P. kiefferi*, sp. nov.
  P. perkinsi Ashm.
Haplogonatopus.
  * *H. vitiensis*, sp. nov.
  H. brevicornis, sp. nov.
Gonatopus.
  * *G. koebelei*, sp. nov.
Neogonatopus.
  * *N. vitiensis*, sp. nov.
Epigonatopus.
  * *E. fallax*, sp. nov.
Neodryinus.
Dryinus.
  D. ormenidis Ashm.
Chlorodryinus.
  C. pseudophanes, sp. nov.
Neochelogynus.
  N. ignotus, sp. nov.
Prosanteon.
  P. melanostigmus, sp. nov.

PIPUNCULIDAE.

Pipunculus eutrichodes, sp. nov.

DESCRIPTIONS OF SPECIES.

Pseudogonatopus.

On page 35 of Pt. 1, in the Synopsis of Species of this genus, the names *P. junctorum* and *P. saccharetorum* should be transposed.

Pseudogonatopus perkinsi, Ashm.

Gonatopus perkinsi, Ashmead, Faun. Haw. Vol. I, pt. III, p. 293.

Hab: Molokai, Maui, Hawaii, widely distributed, but not abundant. I have found the larval sac on Delphacids on *Pipturus* on the Island of Hawaii. There is little doubt that *Labeo hawaiiensis* Ashm. is the male, as I have taken this *Pseudogonatopus* in the same spot as the other.

Pseudogonatopus melanacrias, sp. nov.

Black, the face, the legs and the basal three antennal joints, pale, yellow or yellowish; the front femora more or less dark, the intermediate and posterior ones sometimes to a less degree darkened, the antennal joints, excepting the first three, black or at least dark, the apical joint not pale. Thorax generally entirely black, except the lateral and posterior margins of the pronotum, which are yellow or ferruginous. In one example the posterior lobe of the pronotum and the middle of the propodeum are more or less of a dark brown or pitchy colour. Head above dark brown or castaneous.

Antennae slender, the third joint long, twice as long as the fourth; top of the head shining and smooth, and moderately deeply concave. Pronotum with deep transverse furrow or constriction, the surface smooth and shining. Mesonotum very narrow, the propodeum long, the lateral anterior angles effaced, finely transversely rugose in front and posteriorly, and between these areas smooth and shining. The thorax is without clothing of erect hairs. The abdomen is smooth and shining and more or less yellow or brown just behind the petiole. Length 3 mm.

Hab: Suva, Fiji; bred from Delphacid on the grass *Zoysia pungens*.

Pseudogonatopus kiefferi, sp. nov.

Head above, and abdomen black; the thorax and legs ferruginous, the latter partly dark or black, especially the coxae, the middle and hind tibiae at the apex, and the tarsi on their apical joints. Lower part of face pale; antennae with the second, third and fourth joints, and the base of the fifth more obscurely, ferruginous, the apical joint yellowish, the scape yellowish or white, dark above.

Head very dull, with dense fine puncturation, the third antennal joint very long, nearly twice as long as the fourth, and three times as long as the second. Pronotum shining, with some sparse indefinite punctures; the propodeum dull, and coarsely rugose over its whole surface, the anterior lateral angles distinct, not so rounded off as to be effaced. The propodeal rugosity is transverse in front, then becomes more irregular and somewhat longitudinal, while posteriorly it is again regularly transverse. There is no erect pilosity, and the legs have only a very short and inconspicuous pubescence. The abdomen is smooth, shining and glabrous. Length 4.5 mm.

This large and beautiful species is distinguished from any other described by me by the very strong sculpture of the propodeum.

Hab: Suva, Fiji; bred from a cocoon collected by Koebele on a tree, on which many examples of a Fulgorid, *Vanua vitiensis*, were noticed.

Haplogonatopus.

In Pt. 1, page 39, line 10 from the top, for 'preceding' should be read 'following.' The mouth-parts of *Haplogonatopus* are similar to those of *Paragonatopus*, not *Pseudogonatopus*. The above correction was overlooked, when a rearrangement of the genera was made before publication.

Haplogonatopus vitiensis, sp. nov.

Black, but in parts, especially the thorax, dark brown, the legs obscure yellowish brown; two basal joints of the antennae and the third more or less at its base, yellow, the face and mandibles also yellowish, the teeth of the latter dark.

Head very deeply concave, black above, and with a very dense minute puncturation or sculpture rendering the surface dull. Antennae with the third joint less than twice as long as the fourth, the apical one only obscurely pallid at the tip. Pronotum dark brown, smooth and shining, the transverse furrow very obsolete; the mesonotum dull, rather paler than the pronotum, the propodeum bare, transversely rugose in front and posteriorly, and between these parts smooth and shining on the dorsum, the anterior lateral angles effaced. Abdomen black smooth and shining. Length 2½ mm.

Hab: Suva, Fiji; one female from a Delphacid on *Zoysia pungens* (Koebele 2377). Bred with *Pseudogonatopus melanacrias*, which it considerably resembles superficially.

Haplogonatopus brevicornis, sp. nov.

Head and thorax dark brown or castaneous, the mesothorax and posterior part of propodeum paler, more yellowish brown; the face, two basal antennal joints, the third more or less, and the apical one, yellow or brownish yellow. Legs brownish fuscous, yellower in parts, the tarsi except the apical joints paler yellow. Abdomen black.

Head deeply concave, smooth and shining, the antennae short, the third joint about twice as long as the second, the seventh hardly longer than wide. Thorax smooth and shining, glabrous, and without evident sculpture, the propodeum strongly convexly raised, and very smooth on its anterior portion in front of the spiracles, posteriorly without transverse rugulosity, at most with very feeble indefinite sculpture. Legs without noticeable hairs. Length 2 mm.

This species is obviously distinct from *H. apicalis* by the smooth shining propodeum, apart from many other characters. Only a single specimen was bred, and, owing to the manner in which it is carded, I have not dissected the palpi, but it is probably rightly referred to *Haplogonatopus*. The variegated larval sac is like that of *H. apicalis*.

Hab: Tweed River, Queensland side. Koebele 2232.

Gonatopus koebelei, sp. nov.

Shining brown, abdomen and apical half of the antennae black, the legs for the most part paler than the thorax, the basal dilatation of the hind femora and their extreme tips noticeably darker than the part between.

Head above deeply concave, smooth and shining; second joint of antennae slender and quite elongate, the third longest of all and very greatly longer than the fourth. Thorax ferruginous brown, nearly unicolorous, or the mesonotum a little paler; mesonotum and propodeum with fine and long hairs, the latter finely transversly rugose posteriorly, elsewhere smooth and shining like the pronotum. Legs clothed with fine, longish hairs. Abdomen shining black, or slightly brownish-tinged, very sparsely pilose. Length 3 mm.

This is a true *Gonatopus* with 5-jointed maxillary palpi, three distinct joints beyond the geniculation.

Hab. Paramatta, Sydney, N. S. W.; bred from a Jassid (Koebele 2369).

Neogonatopus vitiensis, sp. nov.

Black, the lower part of face, the mandibles, except the reddish teeth, and the three basal antennal joints, yellow, the scape darker above. Front legs with the trochanters entirely pale or marked with fuscous, the femora black or dark brown and pale at the tips, tibiae dark above, the tarsi pale, yellow or brownish yellow. Middle and hind legs prettily variegated with dark and yellow, the trochanters, tip of femora and middle of tibiae being pale, the tarsi brownish, blacker towards the apex.

Head very little concave above, the surface not much shining, the microscopic sculpture excessively fine. Whole thorax sparingly clothed with short erect grey hairs; the pronotum more or less shining, the rest of the thorax duller, and densely minutely punctate or shagreened; the propodeum elongate and not at all abruptly raised in the spiracular region. Front trochanters unusually short and robust, not with the usual long stalk. Abdomen smooth and shining and very sparsely pilose. Length 3-3.5 mm.

This interesting species in the structure of the trochanters and the shape of the head approaches the genus *Pachygonatopus*.

Hab: Suva, Fiji; bred from a small Jassid on grass (Koebele 2378).

Epigonatopus fallax, sp. nov.

Black, the clypeus more or less yellowish, the mandibles white with red teeth, three basal antennal joints yellow; the abdomen behind the petiole slightly brownish or pitchy. Legs with the apices of the coxae, the trochanters for the most part, the apical thin part of the femora, except the tips of the hind ones, yellow; front tibiae and tarsi testaceous, middle and hind tibiae dark at base and tips and paler between, the tarsi fuscous. The superficial appearance of this species owing to its black colour and variegated legs is very like that of *Neogonatopus vitiensis*.

Head deeply concave, and the surface shining, the third antennal joint long and very slender, one and a half times as long as the fourth. Pronotum smooth and shining, the rest of the thorax duller, propodeum elongate and not very high, very finely transversely rugulose at the sides and posteriorly, and without clothing of erect hairs. Legs not noticeably hairy. Length 3 mm.

This species differs greatly in superficial appearance from *E. solitarius*, which has a ferruginous thorax, but structurally it is rather closely allied.

Hab: Mittagong, N. S. W.: collected in grass, January 18th, 1905, by Koebele.

Neodryinus.

This name in the list of species, on page 29 of Pt. 1, three lines from the bottom, is by error printed as *Neogonatopus.*

Dryinus Latr.

The generic characters of female *Dryinus*, as given by different authors, disagree so in such essential points, that without specimens or an adequate description of the type species, I cannot fix these characters. Latreille in his characterization of the genus in 1809 clearly confounded characters peculiar to *Gonatopus* with those of *Dryinus*. His original description in 1805 is not accessible to me. Marshall in his paper describing *D. tarraconensis* gives no characters of use to me, but the figure of this insect is useful for generic purposes. Haliday shows well the distinction between the mouth-parts of *Dryinus* and *Gonatopus*. I herewith give some of the diverse characterizations of *Dryinus* as given by different authors.

Latreille, 1809.

Mandibles 4-dentate.
Maxillary palpi 5-jointed.
Labial 3-jointed or with 2 distinct.
Parapsides ?

Marshall, 1868.

Characters of mouth-parts entirely omitted.
Parapsidal furrows distinct in figure and parallel.

Haliday, 1833.

Maxillary palpi 6-jointed.
Other characters not mentioned.

Ashmead, 1893.

Mandibles 3-dentate.
Maxillary palpi 6-jointed.
Labial palpi 2-jointed.
Parallel parapsidal furrows figured on plate.

True Characters of *Dryinus ormenidis* Ashmead.

Mandibles 4-dentate.
Maxillary palpi 6-jointed.
Labial palpi 3-jointed.
No distinct parapsidal furrows.

Dryinus ormenidis Ashm.

Dryinus ormenidis Ashmead, (female); Ent. News, XIV, p. 192.

Labeo typhlocybae Ashmead, (male); loc, cit.; not *Labeo typhlocybae* Ashm. Mon. Proct. N. A. p. 89.

Swezey bred a number of males and females, determined as above by Ashmead, from cocoons obtained from the Fulgorid, *Ormenis pruinosa.* He rightly concluded that they were sexes of one species, as was subsequently confirmed by breeding hundreds of both sexes from cocoons sent from N. America by Koebele. Copulation was observed on many occasions. The males retained by Swezey do not in any way agree in the structure of the antennae with Ashmead's description of these parts in the original example of *Labeo typhlocybae,* bred by Riley from a *Typhlocyba* on *Celtis.* If that description is correct, it is not only utterly impossible that the type of *L. typhlocybae* can belong to the same species as the male of *Dryinus omenidis,* but further, it cannot be placed in the same genus in my opinion.

Ashmead's description of type of *Labeo typhlocybae.*	Description of three males in Swezey's collection.
"Antennae 10-jointed"; "the pedicel is more than twice as long as the scape; the first flagellar joint is two-thirds the length of pedicel; the fourth and fifth equal and a little longer than the first."	The scape is stout and as long or longer than the pedicel, not shorter; the first flagellar joint is very long, about equal to the scape and pedicel together, and distinctly longer than the following joints of the flagellum.

Chlorodryinus pseudophanes, sp. nov.

Black, the antennae, the margins of the pronotum (more widely at the sides posteriorly) and for the most part the front legs, the tarsi, and the apical compressed abdominal segment, ferruginous. Scape of antennae in front and the clypeus marked with yellow, the mandibles yellow with red teeth. Wings with a transverse smoky band through the basal cells and a large ante-

Head in front dull and very densely punctured. Pronotum pubescent, shining, somewhat rugosely punctured; mesonotum quite dull, except the smooth anterior constriction, very densely sculptured, being finely granulate or shagreened; scutellum somewhat shining and punctured; propodeum with fine and close rugose reticulation. Abdomen smooth and shining. Length 4 mm.

Agrees well generically with *Chlorodryinus pallidus* in the incompletely margined head, the simple pronotum, the incomplete parapsidal furrows, etc., and only its superficial appearance is that of a *Paradryinus.*

Hab: Brisbane, Queensland; a single female was captured by Koebele on low bushes.

Neochelogynus ignotus, sp. nov.

Black, scape of antennae and front legs yellow or ferruginous, second and third joints of antennae obscurely reddish, the rest black. Middle and hind femora and tibiae more or less brown or dark-coloured, the tarsi except the apical joint pale yellow; the mandibles pale.

Head large, densely rugose or rugosely punctate, but the sculpture is not coarse, and is still finer on the front, which is clothed with silvery hairs. Pronotum rugose; mesonotum shining and sparsely punctate; the scutellum and post-scutellum smooth and shining; propodeum finely irregularly rugose, the posterior median area well defined, somewhat smoother, dull and rugulose. Wings with the stigma and radius fuscous, the rest of the neuration pale. Abdomen black, shining and impunctate. Length 3 mm.

This species in the sculpture of the head (which is much finer than in most of the allied species) agrees with *N. nigricornis*, the black antennae of the latter serving at once to distinguish it.

Hab: Sydney, N. S. W.; collected Feb. 2nd, 1905, by Koebele.

Prosanteon melanostigmus, sp. nov.

Black, the mandibles and scape of the antennae ferruginous, the front tibiae and front and middle tarsi pale ferruginous or yellowish, anterior femora and the intermediate and posterior femora and tibiae mostly dark, black or pitchy, hind tarsi dark above. Wings hyaline, stigma dark fuscous.

Head rugose from the coarse shallow puncturation, as also is the pronotum; mesonotum smooth and shining, with a few fine punctures; propodeum finely irregularly rugose, its posterior median are a well defined, smoother, and in certain aspects slightly shining. Length 3 mm.

Distinguished at once from *P. chelogynoides* by the dark stigma and the colour of the legs.

Hab: Mittagong, N. S. W.; collected on *Melaleuca*, January 18th, 1905, by Koebele.

PIPUNCULIDAE.

Pipunculus eutrichodes, sp. nov.

Head black, with the front and face covered with glistening white tomentum, posteriorly with greyish white at the sides, and fuscous in the middle. In the female the head between the eyes in front of the ocelli is shining black. Antennae black, third joint yellow (sometimes somewhat clouded) and distinctly acuminately produced at the apex. Thorax pilose, and clothed with fuscous tomentum, at the sides in front and on the pleura whitish; scutellum with long, fine, erect hairs; metanotum with dense whitish tomentum. Halteres yellow, dark at base. Legs black or piceous, tip of femora, tibiae, and tarsi yellow; the tibiae more or less infuscate or blackish, as also the apical tarsal joint. Abdomen black, shining, clothed with outstanding conspicuous longish pubescence, the first segment with a whitish tomentose band; the second in the female generally noticeably whitish, as also all the other segments at the sides in both sexes; the basal segment is without any row of black bristles at the sides; hypopygium less clothed than the other segments in the male (but similarly in the female) and more or less impressed at the base, with a smooth lateral lobe on the right side. Ovipositor straight and rather short. Wings distinctly smoky, stigma obscure brown, about as long as the fourth costal segment; neuration black or dark brown, more or less pale at the base. Length 3-3¾ mm.

Hab: Cairns district, Queensland. Not common.

DESCRIPTION OF PLATES.

Plate XXXIII.

1. *Eukoebeleia mirabilis*, female.
2. *Bruchomorpha sp?*, containing the ruptured larval sac of *Eukoebeleia*. Several sacs are often found on a single hopper, and both nymphs and adults (long- and short-winged alike) are affected.
3. *Phrynophryes sp.*; the left tegmen and rudimentary wing are displaced and show the empty sac, from which *Chalcogonatopus decoratus* was bred.
4. Nymph of *Tartessus?* in a much collapsed state, from the sac on which was bred a female *Prosanteon chelogynoides*.

Plate XXXIV.

1. *Eurinoscopus sp.*, nymph in ventral aspect, showing the empty larval sac of a *Neochelogynus destructor*, inserted in the usual position behind the posterior coxae.
2. *Eulcimonios sp.* with empty larval sac of *Neochelogynus coriaceus* inserted in the neck.
3. *Athysanus curtisii*, with empty sac of *Neogonatopus brunnescens* placed on the abdomen. The left tegmen is somewhat displaced by the parasite.
4. *Liburnia sp.* nymph, shrunken and distorted, bearing two empty sacs of *Haplogonatopus americanus*.
5. *Colgar peracutus*, nymph much shrunken, with empty sac of *Paradryinus koebelei* beneath the left tegmen.
6. *Perkinsiella saccharicida*, nymph much collapsed and distorted, bearing two empty sacs of *Pseudogonatopus dichromus*. This hopper is an Hawaiian example, that was infected by a parasite imported from Australia, where it attacked small graminicolous *Liburnia*.
7. *Stenocranus dorsalis*, nymph with empty sac of *Pseudogonatopus stenocrani*, attached between the bases of the tegminal pads.
8. *Privesa aphorphoroides?* nymph much shrunken, and with the long fan-like caudal filaments removed, bearing two sacs of *Paradryinus venator*, one beneath the tegminal, the other beneath the alar pad. In life the beautiful fan-like filaments are turned back over the body, the parasitic sacs are only seen when the tail is depressed.

9. *Deltocephalus sp.*, nymph shrunken and distorted, bearing an empty larval sac of *Neoogonatopus dubiosus.*

Plate XXXV.

1. *Idiocerus*, nymph with the abdomen much shrunken, and bearing an empty sac of *Neochelogynus cognatus.*
2. *Perkinsiella saccharicida*, nymph with sac of *Echthrodelphax fairchildii* under the left tegmen.
3. *Ipo conferta* nymph, much shrunken and collapsed, bearing six empty sacs of *Paranteon myrmecophilus.* One of the sacs is not visible in the dorsal aspect of the hopper.
4. *Neodryinus raptor,* cocoon, subdiagrammatic. The two larval skins which are pierced by 8 distinct spiracles on each side, and form nearly the whole of the sac, are spread out as a roof over the middle part of the cocoon. This middle part contains the pupa, the large outer part of the cocoon serving for attachment to the leaf surface.
5. *Neodryinus koebelei* cocoon. The inner of the two skins is not pierced by evident spiracles, while those on the outer skin are but seven in number on each side, the three stigmata, at one end of each series, being much larger than the others. For the rest the cocoon is like that of *N. raptor.*
6. *Paradryinus threnodes*, empty cocoon, the insect having escaped by cutting out a cap, as seen at one end. The cocoon is densely studded with rounded portions, gnawed from the leaf-surface.
7. *Paradryinus koebelei*, empty cocoon; the patches of leaf-substance are less thickly strewn, and are of more elongate form.
8. *Neochelogynus destructor*; the subterranean cocoon is covered with particles of sand, so that the silken basis cannot be seen; the insect has emerged from the hole at one end of the cocoon, the cap having been entirely detached.
9. *Prosanteon chelogynoides*, female; chelae and adjoining tarsal joints.
10. *Thaumatodryinus koebelei*; chelae and the three preceding tarsal joints. The two teeth before the apex of the chelar claw, and the single lamellate spine near the tip, as well as the two kinds (long and short) of lamellae, placed alternately, on the fifth tarsal joint, are very remarkable in this genus, and were not noticed in my original description.

PLATE XXXVI.

1. *Paradryinus*; six-jointed maxillary and three-jointed labial palpi.
2. *Neodryinus koebelei*; six-jointed maxillary and three-jointed labial palpi.
3. *Prosanteon chelogynoides*; showing similar parts.
4. *Chalcogonatopus gigas*, showing the same.
5. *Neochelogynus nigricornis*; maxillary palpus with 6-joints.
6. *Eukoebelcia mirabilis*; maxillary palpus with six, labial with three joints.
7. *Paranteon myrmecophilus*, showing the same.
8. *Gonatopus australiae*; five-jointed maxillary palpus.
9. *Pseudogonatopus americanus*; four-jointed maxillary palpus.
10. *Neogonatopus dubiosus*; four-jointed maxillary palpus.
11. *Haplogonatopus americanus*; two-jointed maxillary, and two aspects of the two-jointed labial palpus.
12. *Epigonatopus solitarius*; two-jointed maxillary palpus.
13. *Echthrodelphax fairchildii*; four-jointed maxillary palpus.
14. *Paragonatopus nigricans*; two-jointed maxillary palpus.
15. *Pachygonatopus melanias*; three-jointed maxillary palpus.

All the above figures are are drawn with *camera lucida* from dissections mounted in balsam or glycerine; the very short basal joint of the maxillary palpus in some cases is not very distinct. The labial palpus of all the forms of which the maxillary palpi are represented by fig. 8-15, is very short and two-jointed, and is drawn only in the case of *Haplogonatopus* (fig. 11).

Plate XXXVII.

1. *Gonatopus australiae*, chelae.
2. *Pseudogonatopus dichromus*, chelae and preceding tarsal joints.
3. *Epigonatopus solitarius*, chelae.
4. *Paragonatopus nigricans*, chelae.
5. *Chalcogonatopus gigas*, chelae.
6. *Haplogonatopus americanus*, chelae.
7. *Pachygonatopus melanias*, chelae.
8. *Echthrodelphax nigricollis*, chelae.
9. *Neogonatopus vitiensis*, chelae and preceding tarsal joints.

It will be observed that fig. 1, 3, 5, 7, 9, show the similarity between the chelae of the forms of *Gonatopus, sensu* *lat.*, which preys on Jassids, while fig. 2, 4, 6, 8, show these parts in parasites of Gonatopus-like appearance, which prey on Fulgoroids, and which are also very similar to one another, but markedly distinct from those above mentioned. The new genera into which I have divided the old *Gonatopus* are easily determined by examination of these chelae, together with the mouth-parts figured on Pl. XXXVI, fig. 8-15.

10. *Paradryinus koebelei*, chelae and preceding tarsal joints.
11. *Neochelogynus*, chelae and two preceding tarsal joints.
12. *Neodryinus koebelei*, chelae, and three preceding tarsal joints.
13. *Paranteon myrmecophilus*, chelae and three preceding tarsal joints.
14. *Eukoebeleia mirabilis*, chelae. The single lamellate spine at the tip of the process of the fifth tarsal joint may be compared with that in the same position on the chelae of *Thaumatodryinus*.
15. *Paradryinus koebelei*; pronotum in profile, showing its very irregular outline.
16. *Chlorodryinus pallidus*; pronotum with almost regularly convex outline.
17. *Paradryinus*; mesonotum showing the parapsidal furrows.
18. *Chlorodryinus*; mesonotum showing the same.
19. *Echthrodelphax*; mesonotum showing the same.
20. *Neochelogynus*; mesonotum showing the same.

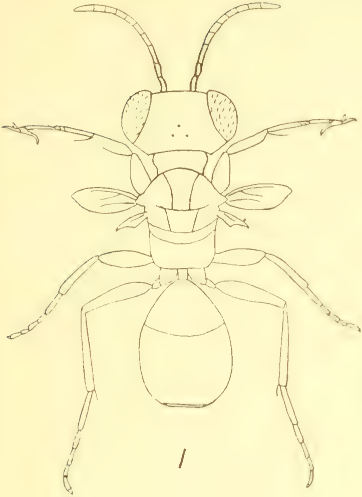
All the figures are drawn from female examples.

PLATE XXXVIII.

1. *Paradryinus koebelei*, showing the mode of disposition of the long front legs, when at rest. The body is supported on a part of the dorsum of the abdomen, which alone touches the surface on which the creature rests. In the case of the example figured the center of gravity is far in advance of the point of contact between the abdomen and the resting surface, but equilibrium is maintained by the grip of the claws of the middle and hind feet. The legs of the left side only are figured, those on the right side holding similar positions. In different species there is some variation in the positions assumed at rest, but the following genera, *Neodryinus*, *Paradryinus*, *Chlorodryinus*, *Thaumatodryinus*, and *Chalcogonatopus*, all rest on the recurved abdomen with the body suberect, or oblique, and

the front legs free, while the rest of the forms described by me assume a normal horizontal position when resting.

2. Head of *Echthrodelphax nigricollis*, male, showing its incrassate form.
3. Head of *Paragonatopus nigricans*, male, showing the usual form in this sex of *Gonatopus sensu lat.*
4. Arrangement of ocelli in *Neodryinus*, male.
5. Arrangement of ocelli in *Paradryinus*, male.
6. Ocelli of *Echthrodelphax*, female.
7. Antenna of female of *Paranteon*.
8. Antenna of female *Neochelogynus*.
9. Pedicel and two first funicle joints of female of *Thaumatodryinus koebelei*.
10. Two apical antennal joints of the same, still more highly magnified.
11. Antenna of male of *Echthrodelphax nigricollis*, showing its extremely slender form, a generic character.
12. Antenna of male of *Paragonatopus nigricans*, showing the less slender form of those organs in this and most of the genera formerly included in *Gonatopus*. This and the preceding figure are drawn under similar magnification.



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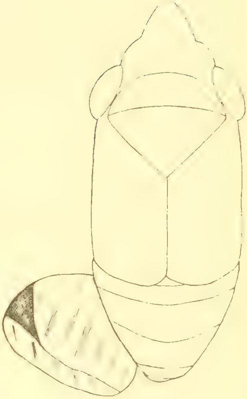

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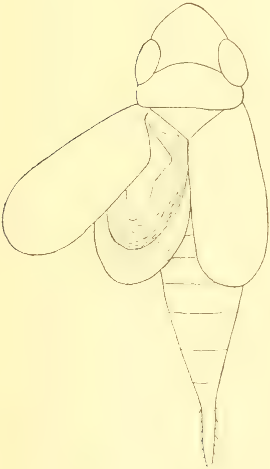

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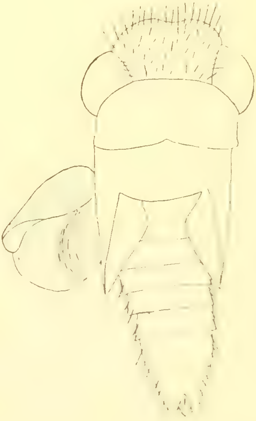
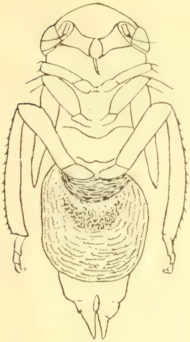


4

Perkins del.

PLATE XXXIII.



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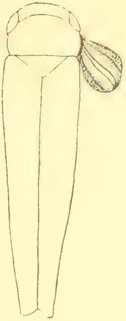

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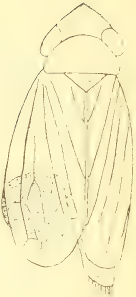

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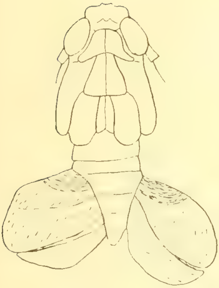

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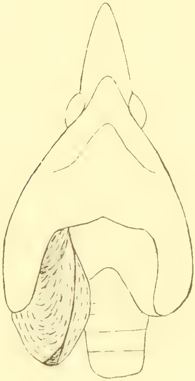

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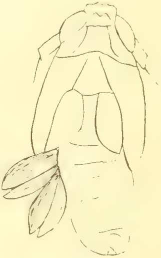

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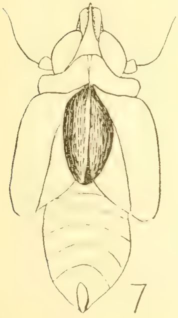

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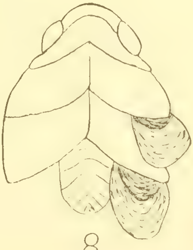

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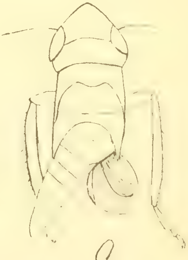

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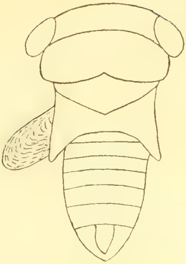
PLATE XXXIV.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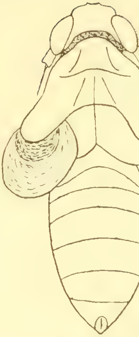
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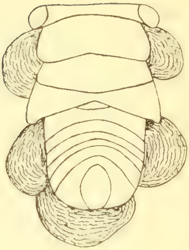
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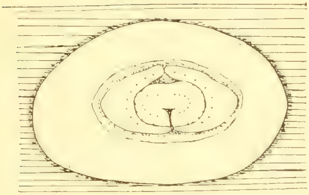
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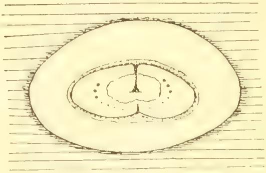
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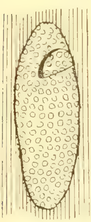
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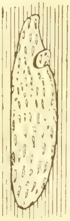
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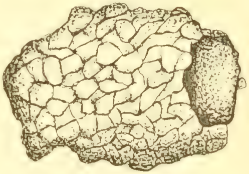
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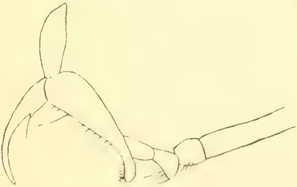
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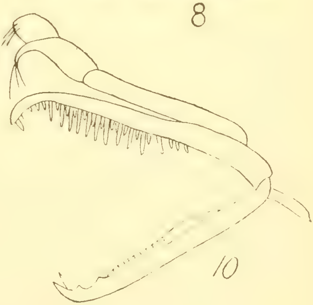
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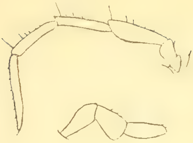
PLATE XXXV.



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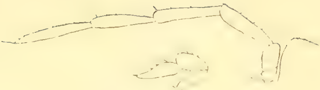

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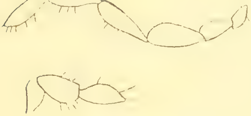

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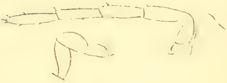

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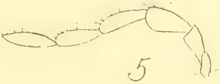

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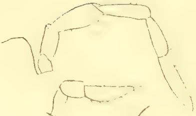

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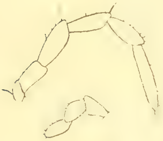

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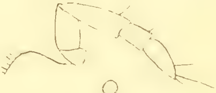

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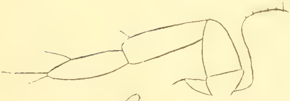

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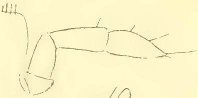

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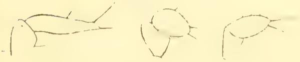

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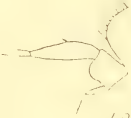

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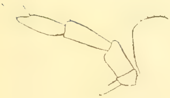

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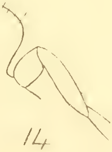

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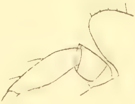

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PLATE XXXVI.

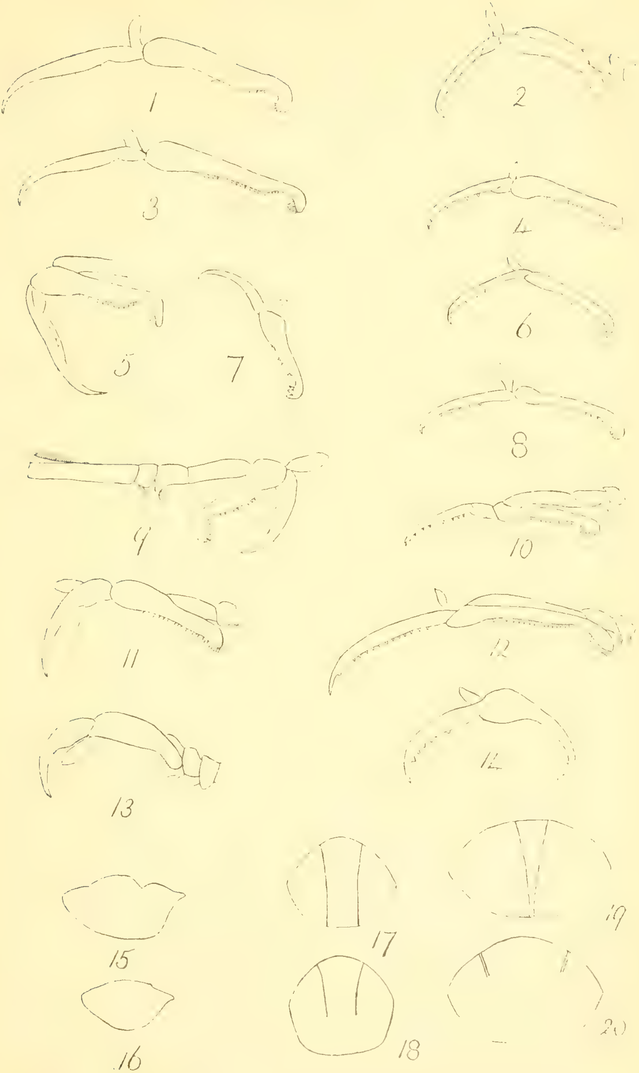
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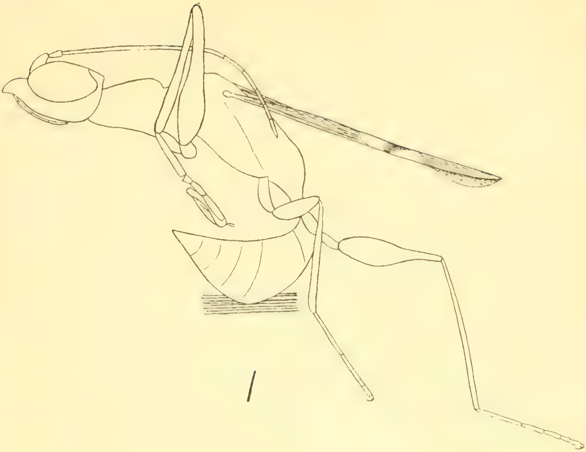
PLATE XXXVII.



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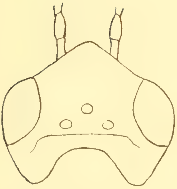

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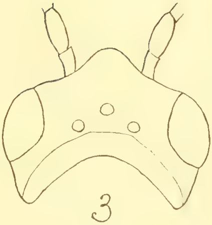

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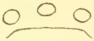

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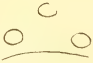

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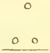

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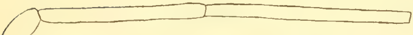

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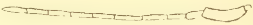

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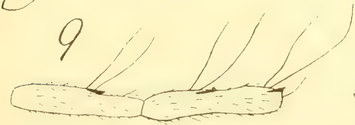

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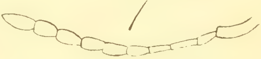

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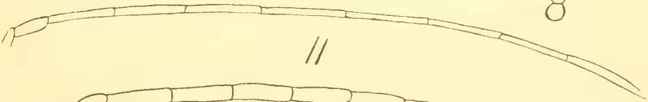

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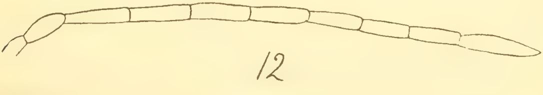

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Perkins del.

PLATE XXXVIII.

INDEX

BULLETIN I

ERRATA.

It is requested that these corrections, when important, be made in the text. It will be observed that, owing to deficiencies of the press, accents on foreign words are entirely omitted.

Page 29, line 25, for "*Neogonatopus*" read "*Neodryinus.*"

Page 35, line 19, for "*P. juncetorum*" read "*P. saccharetorum.*"

Page 35, line 26, for "*P. saccharetorum* " read "*P. juncetorum*"

Page 39, line 10, for "preceding' read "following."

Page 69, line 1, for "Girard" read "Giard."

Page 164, line 15th from top, for "Dube" read "Dubr."

Page 166, diagram, for "ecdysis" read "insta

Page 168, line 4th from top, for "and 2nd joint" read "the 2nd joint."

Page 168, line 6th from bottom, for "even testaceous" read "seven testaceous."

Page 176, line 4th from bottom, for "nercules" read "nervules" for "graduate" read "gradate."

Page 176, line 5th from bottom, for "nercures" read "nervures."

Page 180, line 8th from bottom, between "b" and "e" insert "c, membranous area representing the 8th sternite; d, posterior chitinized emargination of the 8th sternite;"

Page 229, line 3rd from bottom, for figs. "8-19" read "8-10."

Page 231, line 8, for "*lineola*, Fabr," read "*strigula* (Boisd.)"

Page 232, line 8, for "*Verania sp.*" read "*Verania furcifera* (Guerin.)" We are indebted to Rev. T. Blackburn for these identifications.

Page 232, line 26, for figs. "1, 3" read "1-3."

Page 233, line 25, for "fig. 2," read "fig. 3."

Page 234, line 23, for "fig. 3," read "fig. 2."

Page 234, line 32, for Plate "xviii," read "xvii."

Page 236, line 5, for fig. "5," read "6, 6a."

Page 236, line 9, for fig. "6," read "5."

Page 236, line 15, delete, and read "*Oechalia griseus* (Burm.) *Pl. xvii. figs. 5-7."

Page 248, after line 18, add "*E. exitiosus* sp. nov. et typ. gen."

Page 250, line 15, for "oblique line" read "oblique bare line."

Page 271, line 20, for "probocis," read "proboscis."

Page 273, line 12, for "abnormal," read "arboreal."

Page 273, line 4th from bottom, for "tho" read "though."

Page 286, line 5th from bottom, for "Issine" read 'Tetigoniine."

Page 301, line 11, for "discodal," read "discoidal."

Page 302, a line has been dropped in the explanation of the wing-venation (see Plate xxxii); read "(9) *Marginal* (10) *Submarginal*=peripheric nervure *Fieber* (which is often actually the exterior vein.)"

Page 302, line 3rd from bottom, for "clpeus" read "clypeus.'

Page 305, line 25. I find I have used "marginal" here in a sense different from that sometimes employed in other orders where it has a definite meaning. Throughout part 9, "*marginal*" simply means "external" as applied to a cell or vein; thus the subcostal cell and the subcostal vein have often been referred to as "*marginal*."

Page 331, line 24, for "*apicatis*" read *apicalis*."

Page 342 *Eulcimonios* has been incorrectly included in the Macrostelini; it should be placed in the Cephalelini near *Thamnotettix*.

Page 313, No. 137, read *T. opidocephala eximius* sp. nov.

Page 346, the length of *Epipsychidion epipyropis* is 6½ mill.

Page 369, line 9th from bottom, delete "made."

Page 377, between lines 18 and 19, insert "*Acanthuchus* Stal."

Page 407, line 22, for "Tyron" read "Tryon."

Page 412, *Ectopiopterygodelphax* is a synonym of *Tropidocephala* Stal. No. 137 (p. 313) will therefore be known as "*Tropidocephala eximius*."

Page 412, line 6, for "tegmnia," read "tegmina."

Page 416, line 3, for "Pl. xxvii figs. 7-9" read "Pl. xxviii figs. 7-9."

Page 467, No. 22 should have been cited simply as "unknown to me," not as "unrecognizable by the description."

Page 468, line 3, for "biblography," read "bibliography."

Page 478, Pl. xxxi fig. 1, for "*Thaumatoscapus*" read "*Thaumatoscopus*."

Pl. xxii fig. 3, the loral margins should be continued out as far as the frons.

Pl. xxix fig. 5, the sensory organs on the left side of the pronotum have been accidentally omitted.

Pl. xxvii figs. 1 and 4, the median keel of the scutellum has been omitted.

Pl. xxxi fig. 12, the ocelli have been omitted, they are situated much as in fig. 11.

GENERAL INDEX.

INTRODUCTION: General account of work done in Australia, Fiji and the United States i; Koebele's mission to the United States i; Mission of Koebele and Perkins to Australia iii; Mode of sending over parasites v; Handling of Beneficial Insects after arrival vii; Effect of various natural enemies in controlling leaf-hopper xiv; Fungous diseases xvii; On the necessity of further distribution of parasites in the cane-fields xviii; List of parasites and their hosts xxi; Hymenoptera xxi; Coleoptera xxvi; Diptera xxvi; Lepidoptera xxvii; Summary of the Bulletin xxviii; Concluding Remarks xxx.

PART 1 DRYINIDAE—Introductory remarks 3; Lifehistory of *Echthrodelphax* as typical form 7; General habits 10; Economic Value 13; Mature Larvae 15; Cocoons 16; Larval Sac 17; Position of Larval Sac 18; Length of time in cocoon 19; Comparative study of generic characters 20; Mouth parts 20; Thoracic segments 22; Raptorial front legs 23; Natural position 26; Systematic account 28; Bibliography 68.

PART 2 EPIPYROPIDAE—Introductory remarks 75; General account of lifehistory 76; Classification 79; Synopsis of genera 80; Bibliography 84.

PART 3 STYLOPIDAE—General Remarks 90; Effect of attack on their hosts 92; The genera *Halictophagus* and *Elenchus* 93; The larvae 95; The puparia 96; Some relations of parasite and host 97; Classification 98; List of species considered 99; General structure 99; Thoracic segments 101; Descriptions of genera and species 102; Supplementary notes 108; Bibliography 109; Description of Plates 110.

PART 4 PIPUNCULIDAE—General remarks 123; Larva and Puparium 128; Classification 130; List of species described 131; Synopsis 132; Descriptions 137; Bibliography 156; Description of plates 157.

PART 5 FORFICULIDAE—General remarks 163; *Chelisoches morio* 164; *Anisolabis annulipes* 172; Bibliography 172.

HEMEROBIIDAE Chrysopinae 174; General remarks on *Chrysopa microphya* 175.

SYRPHIDAE 177; Bibliography 180; Description of Plates 180.

PART 6 MYMARIDAE—Introductory remarks 187; General account of *Paranagrus optabilis* 188; Classification 190; List of forms described 193; Table of genera and species 194; Descriptions 194; Bibliography 203.

PLATYGASTERIDAE 200; Genus and species described 200; Bibliography 203; Description of Plates 204.

PART 7 Introductory Remarks 211—LOCUSTIDAE, *Xiphidium varipenne*, Distribution 212; Feeding Habits, 212; Egg parasite, (i. e., *Paraphelinus xiphidii*) 214; Lifehistory 215; Description 215; Variation 218; *Xiphidium latifrons* 223.
COCCINELLIDAE: *Callineda testudinaria* 224; Lifehistory 225; *Coccinella repanda*, lifehistory 228; Parasite 229; *Verania frenata* 229; Lifehistory 230; *lineola*, lifehistory 231, *sp.* 232; MALACHIIDAE, *Collops quadrimaculatus* 232. REDUVIIDAE; *Zelus peregrinus* 232; Lifehistory 233; *Reduviolus blackburni* 234; Lifehistory 235; ANTHOCORIDAE; *Triphleps persequens*, lifehistory; *Physopleurella mundulus* 235; lifehistory 236; CIMICIDAE; *Oechalia grisea* 236; Literature cited 236; Explanation of Plates 237.

PART 8 ENCYRTIDAE, EULOPHIDAE, TRICHOGRAMMIDAE—General Remarks 241; Habits of the parasites considered 241; Parthenogenesis 246; Classification 246; Species and genera described or named 248; Description of genera and species 249; Bibliography 265; Descriptions of Plates 266.

PART 9 LEAF-HOPPERS—General Introduction 271; Biological Survey 273; Lifehistories 273; Flight-organs 280; Maternal Affection 285; Stridulation 285; Relations with ants 285; Systematic position and classification 287; Survey of previous systems 287; System adopted 295; Outer framework 297; Criticism of previous systems 303; Summary 309; List of new genera and species 310; List of previously known species so far as worked out 316; Descriptions of genera and species 317; Bibliography 468; Descriptions of Plates 475.

PART 10 INTRODUCTORY and General Remarks 483; List of Dryinidae and Pipunculidae discussed, and Descriptions of species 486; Description of Plates 495; Positions at rest of certain forms 498.

SPECIAL INDEX.

N. B.—Species that are merely listed without being discussed are not as a rule included in this index.

COLEOPTERA.

Bruesia 102, australensis, phaeodes 103. stenodes 104.
Callineda testudinaria 224.
Coccinellidae 224.
Coccinella repanda 228.
Collops quadrimaculatus 232.
Deinelenchus australensis 107, 109.
Elenchus 94, 106 tenuicornis 106.
Halictophagus 93, 104, americanus 105, schwarzii 104 (see also Bruesia.)
Malachiidae 232.
Megalechthrus tryoni 106.
Stylopidae.
Verania frenata 229 lineola 231 sp. 232.

DIPTERA.

Baccha monobia 179 siphanticida 177.
Pipunculus agamus 135, 141, anthracias 136, 146, beneficiens 133, 135, 143, cinerascens 134, 135, 142, 262 comitans 134 141, cruciator 133, 135, 137, crypsichalcus 134, 146, dolichostigmus 134, 140, epichalcus 132, 150, erinys 135, 138, eucalypti 133, 138, eutrichodes 133, 135, 494, fallax 134, 141, hawaiiensis 136, 155, helluo 134, 135, 144, heterostigmus 133, 135, 149, homoeophanes 138, 148, hylaeus 134, 139. juvator 136, 152, koebelei 134, 135, 144 lamellifer 134, 141, leimonias 132, 151.

microdes 135, 147, molokaiensis 136, 155, monas 134, 145, nigrotarsatus 136, 155, nyctias 133, 152, oahuensis 136, 153, picrodes 135, 145, pseudophanes 133, 151, rotundipennis 136, 155, swezeyi 136, 154, synadelphus 132, 150, terryi 136, 153, xanthocnemis 133, 136, 148.

HEMIPTERA.

Acanthuchus dromedarius, obtusus 377.
Achilidae 417.
Achilus 417, flammeus 418.
Aglena ornata, ornatula 319.
Aneipo diva, 425.
Anemochrea 329, mitis 330.
Anemolua hanuala 329.
Aneono 358, pulcherrima 359.
Anthocoridae 235.
Anyllis 386, leiala 387.
Aphanophantia 458, cuscuticida 459.
Argeleusa 418, kurandae 423.
Aristyllis 417, adippe 419, 420, aristyllis, omphale 419.
Asiracidae 404, *metamorphoses* 277
Astorga 391, saccharicida 395.
Athysanus *see* Phrynomorphus.
Aufidellus australensis 381.
Aufiterna ptyeloides 382.
Basileocephalus 426, thaumatonotus 429.
Bathyllus albigutta 387.
Benella 418, aliena 420.
Bruchomorpha 26, 495.
Cajeta singularis 391.
Calamister 396, obscurus 403.
Carolus 396, crispus 401.
Centrotypus hospes 378.
Cephalelus 338, brunneus, marginatus 339.
Ceraon *see* Zanophara.
Cercopidae 379, *metamorphoses* 275.
Cicadula histrionicula 361, vitiensis 362.
Cimicidae 236.
Colgar frontalis 458, peracuta 458, 495.
Cythna 418, laon 423.
Daradax 413, 414.
Dardus 443, abbreviata, immaculatus 446.
Daunus *see* Zanophara.
Deltocephalus 496, perparvus 330.
Delphacodes lutulenta *see* Liburnia.
Derbidae 425.
Desudaba aulica, circe, danae 390, 391, maculata, psittacus, 390.
Dicranotropis *see* Peregrinus *and* Perkinsiella.
Dikraneura aneala honiala 360.
Dingkana 374, borealis 375.
Dorycephalus ianthe, subreticulatus 340, trilineatus 341.
Dorydium *see* Cephalelus *and* Paradorydium.
Dryadomorpha 335, pallida 336.
Ectopiocephalus 463, vanduzeei 464.
Ectopiopterygodelphax eximius 412.
Empoa australensis 363.
Epipsychidion 345, epipyropis 346.
Epithalamium aziola 451.
Erythroneura 364, honiala, honiloa, ipoloa 365, lubra, melanogaster 364.
Euleimonios 342, 495, demittendus 342.
Eupteryx haematoptilus 362.
Euricania tristicula 449.
Eurinopsyche obscurata 389.
Eurinoscopus 346, 495, dryas 348, lentiginosus 347, molestia 348, pelamys 349, pelias, soboles 348, sontiates, 347.
Euronotobrachys 443, arcuata 446, plana 446, 447.
Euryaulax 380, callitettigoides 381.
Eurycercopis nigrofasciata 383.
Eurymela bicolor 354 lubra, plebeia 355, rubrolimbata, rubrovittata 354.
Eurymeloides 350, bicinctellus 352, cumulosus 351, hyacinthus 351, lentiginosus 353, ornatus 352, pulchra 353, rubrivenosus 353.
Eurymelops 350.
Eurynomeus 417, australiae 422.
Euryphantia cinerascens 456.
Eurystheus dilatata, 388, perkinsi 389.
Eutettix sellata 331.
Eutropistidae 413, *metamorphoses* 279.
Francesca 417, saleminophila 424.
Fulgoridae 388, *metamorphoses* 277.
Gaetulia chrysopoides 450, 485.
Gedrosia varia 443.
Gelastissus 436, albolineatus 441, histrionicus, suffusus 441, 442.
Gelastocephalus 396, ornithoides 402.
Gelastodelphax histrionicus 411.
Gelastopsis 443, insignis 448.
Gelastorrhachis clavata, diadema 372, 373.
Giffardia dolichocephala 336.

Hadeodelphax pluto 410.

Hasta 391, hastata 394, paupera 395.

Hecalus immaculatus 103, 126, 138, 151, 338, pallescens 338.

Heronax 426, parnassius 431 saccharivora 432.

Hysteropterum 436, dorsale, truncatellum 439.

Idiocerus 496, ipo 466.

Ipo 464, aegrota 466, ambita 465, conferta 465, 496, honiala 466.

Issidae 436.

Issus 436 elongatulus, ridicularius 438, sidnicus, vulturnus 437.

Jamella australiae 460.

"Jassids," larval sacs formed by Belytids.

Kaha 426, perfecta 434.

Kahaono hanuala 361.

Kahavalu gemma 371.

Kosmiopelex 334, varicolor 335.

Kyphocotis 370, tessellata 371.

Lamenia 403, hiva 404, kulia 403.

Levu 427, vitiensis 434.

Limotettix *see* Euleimonios.

"Liburnia" 13, 126, 149, 198, 495, lutulenta 107.

Lipocallia 436, australensis 441.

Lollius 436, acutipennis, angustifrons, australicus 439.

Lucinda lucindae 392.

Macroceratogonia 323, aurea 324.

Majella 417, majella 421.

Massila 459, sicca, sidnica, unicolor 460, walkeri 459.

Membracidae 371, *metamorphoses* 275.

Mimophantia australensis 458.

Myrmecophryne 461, formiceticola 462.

Neomelicharia atomaria 453, furtiva 452.

Nephotettix 331, contemptus 332, nigropicta 333, plebeius 331.

Nesosteles 343, glauca 344, hebe 343, sanguinescens, sordidior 344, taedia 345.

Niculda anadyomene, hebe psyche, 392, 393.

Nisia 426, atrovenosus, grandiceps 427.

Oechalia grisea (-us) 236.

Oliarus 396, alexanor 398, 399, asaica, felis 397, 399, kampaspe, laertes 397, 398, lubra, phelia, sponsa 398, 400, talunia 397, 398.

Olonia 443, picea 445.

Ormenis 12, pruinosa 492.

Ossa 413, formosa, venusta 414.

Paradorydium 104, 339, foveolatum 340, menalus 339, pseudolyricen 340.

Pectinariophyes 386, *metamorphoses* 276, pectinaria 386.

Pedioscopus 349, agenor 350, philenor 349, polydoros 349.

Peltodictya 413, kurandae 415.

Peregrinus maidis 407.

Perkinsiella 282, 404, graminicida 405, 406, saccharicida 199, 405, 406, 495, 496, *metamorphoses* 277, vastatrix 405, 407, vitiensis 405, 406.

Pettya anemolua 343.

Petyllis australensis 382.

Phacalastor koebelei, pseudomaidis 408.

Phaciocephalus 426, vitiensis 428.

Phaconeura 426, froggatti 427, pallida 428.

Phantasmatocera 426, 430, arborea vitiensis 431.

Phenelia 417, elidipteroides 422.

Philadelpheia 426, pandani 432.

Philagra parva 384.

Philya parvula 328.

Phrynomorphus 325, curtisii 495, fatigandus 327, longuinquus taedius 326.

Phrynophyes 327, 495, parvula 328, phrynophyes 327.

Physopleurella mundulus 235, *lifehistory* 236.

Platybrachys 443, chlorocephala 444, oculata 443, sicca 444.

Poekilopteridae 448, *metamorphoses* 280.

Polychaetophyes 384, *metamorphoses* 276, aequalior, serpulidia 385.

Privesa aphrophoroides 449, 495.

Pyrrhyllis 417, pyrrhyllis 421.

Pyrrhoneura 427, saccharicida 435.

Reduviidae 232.

Reduviolus blackburni 197, 234, *life-history* 235.

Rhotana 427, chrysonoe, haematoneura 435.

Rhotidus 366, flavomaculatus 367, horrendus 368, informis 367, ingens 366, ledropsiformis monstrum 367, virides ens 368.

Rhinodictya 413, quaesitrix 417.

salemina 417, francescophila 424.

Sarantus nobilis 374.
Sardis 426, maculosa 433.
Sarnus 436, lucindae 440.
Scaphoideus pristidens 333.
Scolypopa australis 449, kurandae 450, scutata 450.
Sephena argus cinerea, hyacintha, rubida 457.
Sextius assimilis, bipunctata 375, 376, depressus 375, kurandae 375, longinotum 375, 377, virescens 375, 376.
Siphanta, 14, 123, 203, 179, acuta 453, acutipennis 454, breviceps 454, galeata 453, granulata, granulicollis, lucindae 455, rubra 456, subgranulosa 455, toga 454.
Simicrocotis obscura 360.
Smicrotatodelphax 411, perkinsi 412.
Solonaima 396, solonaima 397.
Stenocotis planiuscula 369.
Stenocranus agamopsyche 409, dorsalis 18, 495, saccharivora 409.
Suva 426, koebelei 428.
Swezeyia 426, lyricen 430.
Tartessus 495, syrtidis 341.
Terentius convexus 374.
Tetigonia (*or* Tettigonia) 103, 195, 196, albida 108, 319, albomarginata 323, anemolua, coerulescens 322, kobelei 319, parthaon 321, pasiphae 320, pettimolua 321, quadrata 322.
Tetigoniidae 318, *metamorphoses* 274.
"Thamnotettix" 146.
Thanatodictya 391, anadyomene, hebe, 392, 393, lucindae 392 praeferrata 392, psyche 392, 393.
Tharra 324, labena 325.
Thaumatoscopus galeatus 462.
Thomsonia arcuatus 337, kirschbaumii 338, lineolatus 337.
Thyrocephalus 426, leucopterus 430.
Triphleps persequens, *lifehistory* 235.
"Typhlocyba" *see* Empoa, Erythroneura and Eupteryx.
Vanua 413, 415, vitiensis 416, 488.
Vulturnus vulturnus 463.
Zanophara tasmaniae 373, vitta 374.
Zelus peregrinus 211, 232, *lifehistory* 233.
Zygina *see* Erythroneura.

HYMENOPTERA.

Alaptus immaturus 194, 197.
Anagrus 194, columbi, frequens 194, 198.
Anastatus pipunculi 262.
Aphanomerus bicolor 201, niger 201, 202, pusillus 201, 203, rufescens 201, 202.
Belytidae forming larval sacs on Jassids, xxviii.
Centistes americana 229.
Chalcerinys 258, eximia 259.
Chalcogonatopus 31, 34, 46, decoratus 47, 495, gigas 47, 497, optabilis 47, pseudochromus 48.
Cheiloneurus chlorodryini, gonatopodis 261, swezeyi 243, 260.
Chlorodryinus 32, 34, pallidus 57, 498, pseudophanes 492.
Dryinus 32, 491, ormenidis 492.
Echthrobaccha 253, injuriosa 254.
Echthrodelphax 32, 33, 48, 498, 499, *lifehistory* 7, 12, bifasciatus 49, fairchildii 49, 496, 497, nigricollis 49, 497, 499.
Echthrodryinus 252, destructor 253.
Echthrogonatopus exitiosus 256, pachycephalus 257.
Ectopiognatha 254, major, minor 255.
Epigonatopus 31, 45, fallax 490, solitarius 45, 497.
Eugonatopus 31, 46, pseudochromus 48.
Eukoebelea 32, 34, 59, 495, mirabilis 59, 497, 498.
Fulgoridicida dichroma 250.
Gonatocerus 195, cingulatus 194, 196.
Gonatopus 31, 33, 41, 491, australiae 41, 497, koebelei 489, 495, 497.
Haplogonatopus 31, 39, 488, americanus 40, 495, 497, apicalis 39, brevicornis 489, moestus 40, vitiensis 488.
Helegonatopus 257, pseudophanes 258.
Labeo *see* Gonatopus.
Labeo hawaiiensis *see* Pseudogonatopus perkinsi.
Labeo typhlocybae *see* Dryinus ormenidis.
Larval sacs on Jassids formed by Belytidae, xxviii.
Meniscocephalus eximius 249.

Neochelogynus 32, 34, 60, 498, 499, cognatus 61, 64, 496, coriaceus 61, 65, 495, destructor 61, 64, 495, 496, dimidiatus 60, 63, ignotus 493, leiosomus 60, 62, nigricornis 60, 63, 497, nitidus 60, 62, pallidicornis 60, 65, parvulus 61, 65, typicus 60, 61.

Neocladia howardi 251.

Neodryinus 32, 34, 50, 491, 497, 499, koebelei 51, 496, 498, nelsoni, raptor 51, 52, 496, raptor *var.* umbratus 52.

Neogonatopus 31, 42, brunnescens 42, 44, 495, dubiosus 42, 44, 496, 497, erythrodes, obscurissimus, ombrodes 42, 43, pallidiceps 42, 45, pulcherrimus 42, 44, vitiensis 490, 497.

Ooctonus australensis 194, 195.

Ootetrastichus beatus 263.

Pachygonatopus 31, 45, melanias 46, 497.

Paradryinus 32, 34, 53, 497, 498, 499, gigas 54, 55, koebelei 53, 54, 495, 496 to 498, leptias 54, 56, threnodes 54, 55, 496, varipes 54, 56, venator 54, 55, 495.

Paragonatopus 31, 40, nigricans 41, 497, 499.

Paranagrus optabilis, perforator 194, 199.

Paranteon 33, 34, 67, myrmecophilus 67, 496 to 499.

Paraphelinus xiphidii 264 (*see also* 214 *under 'Eggparasite'*).

Polynema reduvioli 194, 196, 235.

Prosanteon 33, 66, chelogynoides 66, 495 to 497, melanostigmus 493.

Pseudogonatopus 31, 34, americanus 35, 37, 497, dichromus 35, 37, 495, 497, dubiosus 35, 39, juncetorum 35, 36, 486 kiefferi 487, kurandae 35, melanacrias 487, opacus 35, 38, palustris 35, 36, perkinsi 487, saccharetorum 35, 36, 486, stenocrani 35, 38, 495.

Pterygogramma acuminata 265.

Saronotum 259, americanum, australiae 260.

Thaumatodryinus 32, 58, 499, koebelei 58, 496, 499.

LEPIDOPTERA.

Agamopsyche 80, 83, threnodes 84.

Heteropsyche 80, 81, dyscrita 82, 83, melanochroma 82, micromorpha 82, 83, poecilochroma 81, 82, stenomorpha 83.

Palaeopsyche melanias 80.

NEUROPTERA.

Anomalochrysa deceptor, gayi, raphidioides 174.

Chrysopa microphya 174 to 177.

ORTHOPTERA.

Anisolabis annulipes 164, 172.

Chelisoches morio 167 to 171.

Labia pygidiata 164.

Xiphidium attenuatum, ensiferum 222, fuscum 212, 222, latifrons 223, nigropleurum, saltans, strictum 222, varipenne 212.

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XVII
1(7): 232-236

1(9): 271-

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